Labor Market Effects of a Minimum Wage: Evidence from Ecuadorian Monthly Administrative Data*

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May 31, 2023

Abstract

When Ecuador raised its monthly Unified Minimum Wage from $170 to $200 in 2008, it affected 35 percent of all private sector workers. We use this unexpected minimum wage hike under former president Rafael Correa to assess the labor market impacts of the minimum wage. We use an administrative dataset that covers all formal sector workers by month. Adopting a differences-in-differences approach at the firm level, we find that the minimum wage hike led to a decrease in labor demand in affected firms by 0.5 percent after one month and by 2.5 percent after four months. We find that the decrease in labor demand resulted from both an increase in job separations and a slowdown in hiring. At the worker level, we find that the minimum wage hike led to a 2.2 percentage point decline in the probability of remaining employed after one month, and the treatment effect rose to 3.9 percentage points after four months. Last, we estimate the effects of the minimum wage hike on wage changes by wage bin throughout the monthly wage distribution. We find that, after one month, wages increased by 17 to 37 percent for workers who were being paid less than $200 and also uncover wage spillover effects up to the 77th percentile of the wage distribution.

Keywords: Minimum Wage, Job Separations, New Hires, Worker Flows, Wage Distribution, Wage Spillover Effects, Differences-in-Differences, Employment, Ecuador
JEL Code: J23; J38; J88

*The opinions expressed herein are those of the authors and do not necessarily reflect the views of Instituto Ecuatoriano de Seguridad Social and/or Ministerio del Trabajo. The data used in our paper are proprietary. Permission to access data was granted by official arrangement between the authors and the Instituto Ecuatoriano de Seguridad Social. We thank Jeffrey Clemens, Timothy Halliday, Jungmin Lee, Sang-Hyop Lee, Gabriel Loumeau, Lester Lusher, Teresa Molina, Patrick Moran, Jorge Olmedo, Marcelo Ortiz, Carlos Torres, Clemence Tricaud, and participants in various seminars and conferences for their useful comments on earlier drafts.

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1 Introduction

Despite a vast number of studies of the labor market impacts of a minimum wage (see Neumark and Wascher, 2008; Card and Krueger, 2015), there have been few studies on the impact of a minimum wage on overall employment, worker flows, and wage distribution. This is partly because there are limited datasets available to researchers interested in studying minimum wage policy at the national level. Here, using an Ecuadorean matched employer-employee dataset that tracks all formal sector workers and firms by month, we provide the first account of the impacts of the Unified Minimum Wage on overall employment, worker flows, and wage distribution at the worker-month level (and at the firm-month level) in Ecuador.

In January 2008, Ecuador raised its Unified Minimum Wage from $170 to $200.[1] We zoom in on the impacts of the wage hike on employment one to four months after the official announcement date (i.e., from January 2008 through April 2008). Although the Unified Minimum Wage increases at the beginning of every year in Ecuador, the minimum wage increase in 2008 was particularly noteworthy for its size.[2] It was also the *first minimum wage rise under President Rafael Correa*. The high-quality administrative dataset that covers all formal sector workers and firms at the monthly level allows us to analyze overall employment, worker flows, and wage impacts of the Unified Minimum Wage by tracking individual-level employment status and wages in each month. No such analysis has been done before at this disaggregated level.

We use a difference-in-differences approach, at the firm level and at the worker level, to estimate the labor market impacts of the minimum wage increase. First, at the firm level, we measure the share of workers who were paid less than $200 (the new monthly minimum wage in 2008) in December 2007, just before the application of the new minimum wage policy. There is substantial variation across firms (i.e., a firm dimension). Since the new minimum wage was introduced in January 2008, we have another dimension (i.e., a time dimension) to conduct difference-in-differences analysis using two-way fixed effects. Our approach relies on the idea that the overall employment effect of the minimum wage policy can have differential impacts across firms. The increase in the min-

[1] Ecuador's minimum wage is set as a monthly amount, not an hourly amount.

[2] In Latin America in the 2000s, as economies grew, many countries implemented socialist policies that sought to increase the real income of workers and reduce income inequality, with the minimum wage being a recurring instrument (de la Torre et al., 2012; Cornia, 2014). In Ecuador, the Unified Minimum Wage (UMW) is an economic policy that seeks to adjust wages annually with its mandatory application to the private sector. Table 1 lists the UMW for the years 2005–2019. The increases each year differed; the increase in 2008 was the largest increase ever seen in Ecuador: a monthly increase of $30 (i.e., a nominal growth rate of 17.6%).

imum wage will reduce labor demand for firms that have higher shares of workers who are paid less than the new minimum wage.

We find, after one month, that the minimum wage increase led to a decrease in the number of employees in affected (treated) firms by 0.5 percent relative to unaffected (control) firms. The treatment effects increase as the sample size expands (i.e., 1.1 percent, 1.3 percent, and 2.5 percent after 2 months, 3 months, and 4 months, respectively). This finding implies that it took some time for Ecuadorian firms to adjust labor demand in response to the minimum wage hike. One might argue that those firms with a higher share of workers receiving less than the new minimum wage were already losing employees (i.e., there was a pre-existing trend). To alleviate this concern, we check the dynamics of treatment effects and find no detectable differences between the treated firms and control firms.

In addition, instead of using a continuous measure of treatment, we define a dummy treatment such that it equals one if a firm's share of workers who are paid less than $200 is equal to or greater than a certain cutoff (e.g., 10%, 20%,...80%, 90%) and find that the results are almost unchanged. Moreover, by varying the cutoff point, we find that the main reduction in employment results from comparing firms with at least one worker who receives less than the new minimum wage and firms with no workers who are paid less than the new minimum wage. Using an event study technique, we also find that the minimum wage slowed the growth rate of employment in the treated firms, but the absolute numbers employed by the treated firms did not go down (see Meer and West, 2016).

Having established that the minimum wage hike reduced the demand for labor in the treated firms, we ask whether those treated firms changed the composition of their labor force by dismissing existing workers or hiring fewer new workers (see Portugal and Cardoso, 2006; Brochu and Green, 2013; Dube, Lester and Reich, 2016). Our high-quality matched employer-employee dataset allows us to measure the firm-level job separation rate, the percentage of employees who left firms after the minimum wage increase, and the firm-level hiring rate—i.e., the percentage of new hires after the minimum wage increase, by month. We find that, after one month, the minimum wage increase led to an increase in the job separation rate in treated firms by 0.5 percentage points relative to control firms with no binding requirement to pay the minimum wage; and the treatment effects increased as time passed (i.e., 0.8 percentage points, 1.1 percentage points, and 1.2 percentage points after 2 months, 3 months, and 4 months, respectively). In addition, after one month, the minimum wage hike led to a decrease in the hiring rate by treated firms by 0.5 percentage points relative to control firms, and the treatment effects increased as

time passed (i.e., 0.8 percentage points, 1.0 percentage points, and 1.7 percentage points after 2 months, 3 months, and 4 months, respectively).

We then turn our attention to the worker-level employment effects of the minimum wage hike. We define a dummy variable that equals one if workers were paid less than $200 (the monthly minimum wage in 2008) in December 2007. Our worker-level approach hinges on the idea that the probability of remaining employed in response to the minimum wage policy can have a differential impact on workers. We find that treated workers have a 2.2 percentage point lower probability of remaining employed than control workers after one month. The treatment effect increases to 3.3 percentage points (after 2 months), 3.7 percentage points (after 3 months), and 3.9 percentage points (after 4 months). The worker-level employment effects are heterogeneous. Young workers under age 25 have a lower probability of remaining employed; female workers have a higher probability of remaining employed; but when we limit our sample to workers just above or below the minimum wage, we find no differential effects by gender.

Last, we estimate the wage effect of the minimum wage by wage bin throughout the wage distribution. Workers are assigned to wage bins based on their monthly wage in December 2007. We find that wages for workers who earned less than the minimum wage (up to the 35th percentile of the wage distribution) increased by 17 to 37 percent after one month. Further, we identify the wage spillover effects up to the 77th percentile of the wage distribution: wages increased by 2 to 14 percent for workers from the 35th percentile to the 77th percentile. The wage spillover effects resonate with findings by Autor, Manning and Smith (2016) that the wage effects extend to percentiles where paying the minimum wage is non-binding. We further investigate heterogeneous wage impacts throughout the wage distribution. We reveal that positive spillover effects were reduced for young workers under age 25 relative to workers age 25 and over; and positive spillover effects were lower for female workers than for male workers.

Our work is related to earlier studies on the minimum wage in many dimensions. First, we focus on the overall employment effect of the minimum wage rather than on specific age groups and/or sectors. Although there is a wide range of existing studies on the employment effects of minimum wages, there is a lack of consensus about the overall effects of an increase in the minimum wage (see Neumark and Wascher, 2008). To the best of our knowledge, Meer and West (2016), Cengiz et al. (2019), and Dustmann et al. (2020) are three notable recent exceptions that investigate the overall employment effects of minimum wages. Using three separate U.S. state panels of administrative employment data covering 1975 to 2012, Meer and West (2016) find that the minimum wage reduces job growth over a period of several years. Cengiz et al. (2019) study the overall employ-

ment effect of minimum wages using state-level minimum wage changes between 1979 and 2016 in the U.S. Although like Meer and West (2016) and Cengiz et al. (2019), we analyze the overall employment effect of the minimum wage, our study differs from theirs because we exploit a change in the Unified Minimum Wage at the national level instead of at the state level. In addition, our units of analysis are the individual and the firm. In this vein, our paper is most closely related to that by Dustmann et al. (2020), who investigate the employment effects of the introduction of a nationwide minimum wage in 2015 using an individual-level German administrative dataset. While Dustmann et al. (2020) also used high-quality administrative individual-level data like ours, our dataset includes data collected monthly rather than yearly, which allows us to investigate short-run dynamic employment impacts of the minimum wage, something that has not previously been possible in this research arena.[3]

Second, regarding the employment consequences of minimum wages, our work is closely aligned with previous studies that found a negative employment effect: a decrease in the likelihood of being employed (Currie and Fallick, 1996; Zavodny, 2000; Neumark and Wascher, 2004); a reduction in hiring by employers (Bossler and Gerner, 2020; Gopalan et al., 2020); a reduction in job growth over time (Meer and West, 2016), and a reduction in work hours in low-wage jobs (Jardim et al., 2017). In contrast, there are many other studies that found no effect on employment (Card and Krueger, 1994; Dube et al., 2007, 2010; Cengiz et al., 2019; Dustmann et al., 2020). We also find some more detailed employment effects of minimum wages. Although a vast majority of studies focused on employment effects of minimum wages for younger and less-skilled workers and found contradicting employment impacts (Card, 1992; Neumark and Wascher, 1992; Neumark et al., 2014; Allegretto et al., 2017), we find that young workers under age 25 have a lower probability of remaining employed after the minimum wage hike in Ecuador. In addition, we find that the negative employment impacts are most pronounced for firms in manufacturing. This finding is closer to findings by Cengiz et al. (2019) that there is some evidence of reduced employment in the tradeable sector.

Third, our work is also related to studies of the wage effects of minimum wages (Lee, 1999; Autor et al., 2016; Rinz and Voorheis, 2018; Brochu et al., 2018; Engbom and Moser, 2018; Cengiz et al., 2019; Dustmann et al., 2020). Among those papers, our empirical anal-

[3] Clemens and Wither (2019) used monthly, individual-level panel data from the 2008 panel of the Survey of Income and Program Participation (SIPP) to study the employment effect of minimum wages. In terms of the unit of analysis and the frequency, our study is close to theirs. We go beyond their analysis, which relied on survey data, by exploiting an administrative matched employer-employee dataset that covers all formal sector workers at a monthly frequency. Note also that Currie and Fallick (1996) studied the employment effects of minimum wage at the individual-level using survey data.

ysis on the wage effect is quite similar to those of Rinz and Voorheis (2018) and Dustmann et al. (2020), who investigate how changes in the minimum wage affect the earnings trajectories of affected workers in the US and Germany, respectively. We also examine the wage effect of minimum wages by tracking individuals over time, but unlike Rinz and Voorheis (2018) and Dustmann et al. (2020), we study the short-run dynamics of the wage effects of the minimum wage.[4] In our analysis, we uncover convincing evidence of wage spillover effects, which is in line with previous findings of wage spillovers by Lee (1999), Autor, Manning and Smith (2016), Engbom and Moser (2018), and Cengiz et al. (2019). In particular, Autor, Manning and Smith (2016) find that the wage effects extend to percentiles where the minimum wage is nonbinding; but due to the measurement error in the survey data they were unable to uncover the true spillover effects. We overcome the data limitation inherent in this research arena using a high-quality administrative dataset to analyze the wage spillover effect by month.[5]

Fourth, there are few studies on the effects of the minimum wage on worker flows. Most previous research has found that minimum wages decrease worker turnover through two channels: (1) a reduction in layoffs and (2) a decline in new hires. Portugal and Cardoso (2006) analyzed the effects of a sharp minimum wage increase for teenagers in Portugal and found evidence of both more separations from employers and less hiring by new and continuing firms. Using Canadian data, Brochu and Green (2013) showed that minimum wages decreased hiring rates and job separation rates, resulting in less labor turnover. Dube, Lester and Reich (2016) and Gittings and Schmutte (2016) showed reductions in labor flows after minimum wage increases in the United States. Consistent with the previous literature, we find that the minimum wage leads to a decrease in the hiring rate for treated firms relative to control firms with no binding requirement to pay the minimum wage. On the contrary, we uncover that the minimum wage leads to an increase in the job separation rate for treated firms relative to control firms. Our finding is in parallel with the canonical Mortensen and Pissarides (1994) model with endogenous separations and the variant Pissarides (2000) model that incorporates uncertainty about match quality: where both models predict that the minimum wage hike increases layoffs due to a reduction in profitable matches (see Dube, Lester and Reich, 2016).

Last, our study also contributes to the literature on the economic effects of minimum wages in Latin American countries, especially Ecuador. There are several studies on Brazil (Lemos, 2009; Engbom and Moser, 2018), Argentina (Khamis, 2013), Mexico (Bosch

[4]We track the wage of individuals after one to four months of the official announcement date of the Unified Minimum Wage.

[5]Again, to the best of our knowledge, none of the studies exploited monthly wage information to assess the wage spillovers.

and Manacorda, 2010), Uruguay (Borraz and González-Pampillón, 2017), Costa Rica (Gindling and Terrell, 2005, 2007), Honduras (Gindling and Terrell, 2009, 2010; Ham, 2018), Colombia (Pérez, 2020), and Ecuador (Canelas, 2014; Wong, 2019). Evidence from this region has shown mixed results regarding the impacts of minimum wages on employment and wages.[6] Despite the vast number of studies on the minimum wage topic in Latin American countries, to the best of our knowledge, none of the previous studies used a monthly administrative dataset that covers the entire universe of formal sector workers.

The rest of the paper is organized as follows. Section 2 describes the history and institutional context of Ecuador's minimum wage system. Section 3 describes the data sources. Section 4 describes a differences-in-differences approach at the firm-level and presents results on employment effects and worker flows in response to the minimum wage hike. Section 5 provides results on employment and wage effects of the minimum wage increase at the worker level. Section 6 concludes.

2 Institutional Background

In the 1980s and 1990s, many Latin American countries pursued a path of economic liberalization, such as lessening government involvement and increasing flexibility in labor market. During this so-called neo-liberal period, Ecuador also pursued a laissez-faire policy that the free market would naturally produce the best and most efficient solutions to economic and social problems.[7] There were several labor market reforms that gave firms more flexibility in hiring and firing workers and that allowed for hourly part-time jobs and labor outsourcing. The last president to implement these kinds of policies was Lucio Gutierrez (2003-2005). These adjustments led to strong social discontent, increasing social protest and political instability. This led to the rise of Rafael Correa (2007-2017), a left-wing economist, whose new constitution in 2008 brought institutional changes, including increased spending on planning and public administration (Sánchez and Polga-

[6] Most of those studies noted that the minimum wage is an important reference for the payment of the labor force in the formal and informal sector in Latin American countries. At the same time, those studies noted that there are serious concerns about the enforcement of and compliance with minimum wage laws, especially in the informal sector where labor laws cannot be enforced easily. Admittedly, the impact of minimum wages in the informal sector is an important topic, but we focus only on the formal sector in Ecuador. Also, researchers have taken into consideration the fact that the minimum wage policy was used as a short-term tool for inflation adjustment because some of those Latin American countries had experienced higher rates of inflation. Given that Ecuador has been dollarized since 2000, the inflation rate has been less than two digits since 2003. Hence, inflation adjustment was not the main focus in the context of Ecuador in 2008.

[7] In Ecuador, the State Modernization Council was in charge of this liberalization model; the policy was known as the "Modernization of the State."

Hecimovich, 2019).

Rafael Correa was elected in 2006 and took office in January 2007. In his first year as president, Correa promoted a new constitution that extends state control over the economy. While the new constitution was being written, President Correa, together with the Assembly, made decisions that would increase the availability of public funds. For example, they eliminated the oil fund and transferred that money to the general government budget (Schützhofer, 2016). The Assembly also approved a tax law that entails an increase in tax rates. The increase in the minimum wage at the end of 2007 was the last strong move of President Correa in his first year.

Table 1: Unified Minimum Wage, 2005-2019

Year	UMW	Nominal Growth Rate	Inflation Rate	Real Growth Rate
	(1)	(2)	(3)	(4)
2005	$150	10.3%	2.2%	8.1%
2006	$160	6.7%	3.3%	3.4%
2007	$170	6.3%	2.3%	4.0%
2008	$200	17.6%	8.4%	9.3%
2009	$218	9.0%	5.2%	3.8%
2010	$240	10.1%	3.6%	6.5%
2011	$264	10.0%	4.5%	5.5%
2012	$292	10.6%	5.1%	5.5%
2013	$318	8.9%	2.7%	6.2%
2014	$340	6.9%	3.6%	3.3%
2015	$354	4.1%	4.0%	0.1%
2016	$366	3.4%	1.7%	1.7%
2017	$375	2.5%	0.4%	2.0%
2018	$386	2.9%	-0.2%	3.2%
2019	$394	2.1%	0.3%	1.8%

Notes: Unified Minimum Monthly Wage data comes from Subsecretaría de empleo y salarios, Ministerio del Trabajo. Inflation Rate data comes from Instituto Nacional de Estadísticas y Censos (INEC). Ecuador is a fully dollarized country. The Sucre was replaced with the US dollar in 2000. Since then, the dollar has served as Ecuador's currency. UMW is the national unified minimum monthly wage in US dollars. Nominal Growth Rate is the percentage change in the Unified Minimum Wage. Inflation Rate is based on the consumer price index. Real Growth Rate is calculated as the difference between the nominal growth rate and the (ex-post) inflation rate.

Even policies that had been implemented since the 1960s, such as the minimum wage policy,[8] took on greater importance once Rafael Correa was inaugurated as president of Ecuador. In Ecuador, the minimum wage has been adjusted mainly to correct the increase in inflation (see Table 1). In 2005, 2006, and 2007, the nominal growth rate of the Unified Minimum Wage was 10.3%, 6.7%, and 6.3%, respectively. After adjusting for the ex-post

[8]It is formerly known as the Minimum Living Wage in Ecuador. Its first nationwide application was in 1968, when it was set at 600 sucres (US$24.31).

inflation rate, the real growth rate of the Unified Minimum Wage in those years was 8.1%, 3.4%, and 4.0%, respectively. In 2008, the minimum wage had an unprecedented jump from $170 to $200, a 17.6% nominal growth rate (9.3% real ex-post growth rate). Since this was the first and largest minimum wage increase after Rafael Correa's inauguration, we consider this increase as an exogenous shock to Ecuador's economy. In the later years of Rafael Correa's administration, Ecuadorian firms could have expected additional minimum wage increases given Correa's 21st-century socialist policies, but there were no sizable increases in the minimum wage after 2008. This is therefore an ideal setting for studying unexpected Unified Minimum Wage increase on overall employment, worker flows, and overall wage distribution in Ecuador.[9]

The minimum wage policy in Ecuador applies to all salaried workers in the private sector.[10] It aims to regulate the remuneration that a worker receives in a month and is valid for one year (a new Unified Minimum Wage is announced every year).[11] In Ecuador, the labor inspectorate of the Ministry of Labor oversees compliance with workers' rights. Companies that fail to pay the minimum wage are subject to what is stipulated in the labor code regarding sanctions for non-compliance.[12]

The national minimum wage setting in Ecuador has two parts. One is the Unified Minimum Wage (UMW), which is reviewed annually in accordance with the Ecuadorian Labor Code. The National Labor and Salaries Council (NLSC), comprised representatives of workers, employers and the government; it is the commission in charge of announcing the new UMW in the form of a ministerial agreement that is published in the Ecuadorian Registro Oficial.[13] If no agreement is reached, the government, through the Ministry

[9]Since 2008, Ecuador has adopted a series of policies that sought to promote labor stability. The 2008 constitution emphasized the objective of generating decent and stable work, as well as the prohibition of outsourcing, labor intermediation, and hourly labor hiring (article 327 on the 2008 constitution). As a result of all these changes, employers were forced to abide by the new regulations and to pay the Unified Minimum Wage (UMW) using yearly contracts that specify monthly wages.

[10]The minimum wage law does not apply to public sector workers. In Ecuador, a labor contract between an employer and an employee can be formalized in different ways. The most common contract is the indefinite contract, which does not have a fixed established date for termination. There are also other types of a labor contract: temporary contract, occasional contract, seasonal contract, contract for certain work, contract for task, and contract for specific work or service within the business line. All these labor contracts must pay the Unified Minimum Wage as a minimum payment, either for a full-time job or for a part-time job.

[11]Unlike in the U.S., where the minimum wage is an hourly rate, in Ecuador the UMW is a monthly rate. The Ecuadorian minimum wage is revised yearly by law. Also, unlike in the U.S., where there are separate state and federal minimum wage laws, Ecuador's minimum wage law is set at the national level.

[12]In addition to investigating a violation of the minimum wage, the labor inspectorate of the Ministry of Labor verifies the compliance with contracts between workers and firms, corroborates individual' affiliation with the social security system, investigates noncompliance with regulations of job security, and performs many other employment-related tasks.

[13]In Ecuador, Registro Oficial is the official media for the publication of the laws, decrees, and other legal

of Labor, decides the new UMW. A key characteristic of the UMW is that the ministerial agreement is announced in December prior to the year that the new UMW is to take effect. The agreement on the minimum wage for 2008 was made public with ministerial agreement No. 00189 on December 27, 2007, and came into effect on January 1, 2008, through its publication in the Suplemento al Registro Oficial No. 242 (see Appendix Figure A.1 and Appendix Table B.2).

The second part of the national minimum wage setting is the Sectoral Minimum Wages (SMW) that governs all minimum wages of different occupations within different sectors of the economy; the SMW is also reviewed every year by the NLSC. Before 2010, the Ministry of Labor determined the occupational structure and the SMW yearly, through sectoral commissions that established the annual adjustment of the SMW. Since these meetings were much more widespread (The Ministry of Labor determined 47 economic sectors in 2008), it was more difficult to convene and reach an agreement, and the ministerial agreements took a long time to be published. In June 2008, the ministerial agreements on the sectoral minimum wage for 2008 were made public on June 5 and June 7, 2008, respectively (Ministerial Agreements No. 68 and No. 79). These agreements took effect on September 11, 2008, through November 26, 2008 (Registro Oficial No. 423 through No. 475; see Appendix Table B.2 for more details). According to the agreements, only the UMW became effective from the date of the agreement (without prejudice to its publication in the Registro Oficial), and all the SMW agreements became effective when they were published in the Registro Oficial.[14] Therefore, the private sector was obligated to follow the UMW only from the date of the agreement, January 1, 2008.[15] Hence, we focus on the changes in *the 2008 Unified Minimum Wage (UMW) only* and confine our period of analysis to 2008M4 using monthly data in order to have a clean identification strategy.

norms emanating from the different functions of the State and Governments.

[14]Please refer to Appendix Figure A.2. This is one example of Registro Oficial that regulates the Sectoral Minimum Wage (SMW). As indicated in blue, the sectoral minimum wage agreement came into effect when it was published in the Registro Oficial.

[15]In 2009, the commissions workshops were not held. Hence those published prior to 2009 were in force for that year. In 2010, The Ministry of Labor together with the Ecuadorian Social Security Institute (IESS) standardized all the labor market information. Since 2010, 21 tripartite commissions were organized according to the International Standard Industrial Classification (ISIC) code. Since 2011, the SMW has been applied to only 21 economic activities, and the resolutions have been released together with the UMW at the end of each year. Job codes are based on the classifications by IESS. Along with the minimum wages for each position, the commissions have also established the rates of remuneration per task that employers have to pay for temporary jobs.

3 Data

We use the Ecuadorian administrative matched employer-employee dataset that covers the entire universe of formal sector workers and firms in Ecuador from May 2007 to April 2008. The dataset comes from Instituto Ecuatoriano de Seguridad Social (Social Security Administration in Ecuador). The dataset includes all individuals who make social security contributions. However, the dataset does not cover the informal sector. To the best of our knowledge, in terms of the disaggregation and granularity of the dataset, the most comparable and similar dataset that has been used in the minimum wage literature is a matched employer-employee dataset in Denmark (see Kreiner, Reck and Skov, 2020).[16]

The variables in the dataset include a person identifier, age, gender, occupation description, individual classification, monthly remuneration, days worked in a month, a firm identifier, and an industry code for the firm.[17] In the dataset, individuals are classified as follows: "Privada", "Pública", and "Voluntario / Independiente". "Privada" refers to private sector and individuals who work for private firms are classified in this category. "Pública" means public sector and individuals who work in the public sector are classified in this category. "Voluntario" refers to voluntary contributors such as non-working individuals. "Independiente" means independent contributors who work for themselves as freelancers or business owners rather than for an employer. Since some individuals have part-time jobs, we convert monthly remuneration into monthly wages using the information on days worked for each individual. According to the minimum wage law, both full-time and part-time workers should receive at least the monthly minimum wage. The wage in our dataset is the base pay, not including benefits, bonuses, or raises. Note also that each person can match with more than one firm in a month (e.g., a worker can have multiple part-time jobs). Since the minimum wage law is applied at the worker-firm level (i.e., job-spell level), we keep all those observations. There are 13 Broad Industries and 22 Narrow Industries in the dataset (See Appendix Table B.1). Each observation can have only one industry code (i.e., either Broad Industry or Narrow Industry) in our dataset. There is one-to-many mapping between Broad Industry and Narrow Industry. Three narrow industries (i.e., A19, A20, and A21) and three broad industries (i.e., 10, 98, and 99) do not have a clear mapping between the two.

In order to construct our primary sample from the raw dataset, we first exclude "Pública" and "Voluntario / Independiente" because the minimum wage does not apply to public

[16] Kreiner, Reck and Skov (2020) used a Danish monthly administrative dataset; here we exploit minimum wage discontinuity (not age discontinuity), and our study covers all age groups.

[17] Note that both a person identifier and a firm identifier are randomized in our dataset. Therefore we cannot identify firm/worker identities, but we can track firm/worker IDs over time using randomized IDs.

sector workers, non-working individuals, and self-employed individuals. We also drop negative observations of monthly remuneration and exclude observations if days worked is less than 0 and more than 30.[18] We also drop observations that do not have industry classifications (they are either missing an industry code or are in industry 99—activities that do not have classification codes). In Registro Oficial No. 242 (which regulates the Unified Minimum Wage), the minimum wage for domestic service workers, craft workers, and collaborators in micro-enterprises was $170 (see Appendix Figure A.1). Although we cannot pinpoint an exact occupation for each individual in our dataset, based on our thorough investigation, workers in those four industries (i.e., A19. Services, 11. Handcraft Activities, A09. Handcraft, and 98. Outsourcing Activities) were most likely to be domestic service workers, crafts workers and collaborators in micro-enterprises. To reflect this fact in Registro Oficial No. 242, we drop those four industries. In the end, there are 11 industries in our primary sample, which can be used as industry or industry-time fixed effects in our analysis.

After cleaning the raw dataset, in Table 2 our primary sample contains a total of 734,409 observations (i.e., job-spells) in 2007M12 and ended with a total of 798,104 observations in 2008M4. The total number of workers ranges from 726,516 to 786,825; and the total number of firms ranges from 65,712 to 70,505. In Column (4), the average monthly wage is presented. We can identify an increase in the average monthly wage from $413.2 in December 2007 to $428.8 in January 2008, an increase of $15.6, possibly due to the minimum wage hike. In Column (5), the share of male workers is about 63 percent. In Column (6), the average age is about 35.2.

Table 2: Summary Statistics, 2007M12-2008M4

Time	# of obs (1)	# of workers (2)	# of firms (3)	Monthly wage (4)	Male (5)	Age (6)
2007M12	734,409	726,516	65,712	413.2	0.63	35.3
2008M1	754,795	744,386	67,607	428.8	0.63	35.2
2008M2	758,032	748,129	68,441	430.5	0.63	35.2
2008M3	764,624	754,791	69,313	436.1	0.63	35.2
2008M4	798,104	786,825	70,505	434.6	0.63	35.1

Notes: The sample period is from December 2007 to April 2008. In Column (1), the total number of job-spells (i.e., the number of observations) is presented. Column (2) reports the total number of workers. Column (3) presents the total number of firms. In Column (4), the average monthly wage (= monthly remuneration $\times$ days worked / 30) is presented. Column (5) reports the share of male workers. Column (6) reports the average age of workers.

In Table 3, the share of workers who were paid less than $200 (the monthly minimum

[18] Days worked in full-time jobs is recorded as 30 in the dataset.

wage in the year 2008) was 35 percent (257,709 workers out of 726,516 workers) in December 2007. Female workers were more likely than male workers to receive less than the new minimum wage (38 percent vs. 34 percent). People aged 15 to 24 and people aged 65 and older were more likely to receive less than the new minimum wage (53 percent and 48 percent, respectively). We also identify industry heterogeneity such that workers in 9. Community, Social, and Personal Services, 1. Agriculture, Hunting, Forestry and Fisheries, 5. Construction were more likely to earn less than the new minimum wage (50 percent, 49 percent, and 43 percent, respectively); while workers in 2. Mines and Quarries, 4. Electricity, Gas, and Water, 8. Financial Institutions, Insurance, and Real Estate were more likely to be paid more than the new minimum wage (11 percent, 12 percent, and 18 percent, respectively).

Table 3: Workers Affected by the New Minimum Wage, 2007M12

	# of workers (wage $<$ \$200), A (1)	Share A/C (2)	# of workers (wage $\geq$ \$200), B (3)	Share B/C (4)	# of total workers, C (5)
Panel A. Gender					
Male	153,467	0.34	300,505	0.66	453,972
Female	104,242	0.38	168,302	0.62	272,544
Panel B. Age					
15-19	9,739	0.53	8,588	0.47	18,327
20-24	44,121	0.41	63,210	0.59	107,331
25-54	182,344	0.33	367,567	0.67	549,911
55-64	16,814	0.41	24,322	0.59	41,136
65 more	4,651	0.48	5,115	0.52	9,766
Panel C. Industry					
1. Agriculture	48,894	0.49	51,433	0.51	100,327
2. Mines & Quarries	1,153	0.11	8,915	0.89	10,068
3. Manufacturing	36,513	0.27	97,122	0.73	133,635
4. Electricity	1,325	0.12	10,082	0.88	11,407
5. Construction	16,666	0.43	22,491	0.57	39,157
6. Wholesale & Retail	78,687	0.38	130,881	0.62	209,568
7. Transportation	11,548	0.36	20,850	0.64	32,398
8. Finance	8,757	0.18	39,119	0.82	47,876
9. Community Services	31,057	0.50	31,302	0.50	62,359
A20. Teaching	15,714	0.30	37,115	0.70	52,829
A21. Health Services	7,395	0.27	19,497	0.73	26,892
Panel D. Total	257,709	0.35	468,807	0.65	726,516

Notes: The sample is based on December 2007. In Column (1), the number of workers who were paid less than \$200 is presented. Column (2) reports the share of workers affected by the binding minimum wage. Column (3) presents the number of workers who were paid more than or equal to \$200. Column (4) presents the share of workers who were paid more than or equal to \$200. Column (5) reports the total number of workers.

At the firm level, the share of firms with at least one worker received less than the

binding minimum wage was 79.5 percent (52,209 firms out of 65,712 firms).[19] Clearly, the breadth of the 2008 minimum wage increase under former president Rafael Correa was quite sizable. Note also that, in January 2008, the share of workers who received less than $200 was 4.3 percent (i.e., 32,231 out of 744,386 workers), suggesting that Ecuadorian firms generally complied with the minimum wage law. In the following sections, using more rigorous empirical methods, we investigate how firms and/or workers responded to the 2008 minimum wage hike.

4 Firm-Level Results

4.1 Baseline

We estimate the impact of the minimum wage on overall employment by specifying the following regression:

$$\ln E_{it} = \alpha_i + \beta \text{FA}_i \times \text{Post}_t + \gamma_{s(i)t} + \varepsilon_{it} \tag{1}$$

where i denotes a firm, s means industry, and t indicates time. The time horizon begins in 2007m9 and ends in 2008m4. The dependent variable, $\ln E_{it}$, denotes the log of the total number of formal workers for firm i in time t. FA_i is defined as firm i's share of workers who receive less than $200 (the monthly minimum wage in 2008) in 2007m12. Post_t is a dummy variable that equals one if t is after January 2008. α_i is firm fixed effects, and $\gamma_{s(i)t}$ is industry by time fixed effects. A detailed description of industry is reported in Appendix Table B.1.[20] Standard errors are clustered at the firm level. Our main coefficient of interest, β, captures the impact of the minimum wage on a firm's employment during the post-treatment period after controlling for unobserved firm and industry by time fixed effects.

Table 4 reports our baseline results. In column (1), we use two time periods (2007m12 and 2008m1) to estimate the treatment effect. The coefficient of our interest (β) is negative and statistically significant at 5 percent level. Quantitatively, the minimum wage reduces treated firms' employment by 0.5 percent relative to control firms that are not bounded by the new minimum wage. Our estimates remain statistically significant at the 5 percent level and the magnitudes increases when we expand our sample period. In column (2), we use the sample from 2007m11 to 2008m2. In column (3), we use the sample from 2007m10 to 2008m3. In column (4), we use the sample from 2007m9 to 2008m4. The

[19] Please refer to Figure 2 in Section 4 for the detailed firm-level distribution on this variable.
[20] There are 11 industries in the sample.

treatment effects are 0.5 percent (column 2), 0.6 percent (column 3), and 0.8 percent (column 4), respectively. The increasing treatment effects suggest that the negative impact of minimum wage on firms' labor demand may take some to become evident.

Table 4: Baseline Results

	Dependent Variable: Log of Employment			
Sample	+/- 1m	+/- 2m	+/- 3m	+/- 4m
	(1)	(2)	(3)	(4)
FA × Post	-0.005**	-0.005**	-0.006**	-0.008***
	(0.002)	(0.002)	(0.002)	(0.003)
Fixed Effects:				
Firm	Yes	Yes	Yes	Yes
Industry-Time	Yes	Yes	Yes	Yes
Observations	130,456	260,959	388,631	514,308
R-squared	0.993	0.987	0.981	0.976

Notes: The dependent variable is the log of the total number of formal workers. In Column (1), the sample period is from 2007m12 to 2008m1. In Column (2), the sample period is from 2007m11 to 2008m2. In Column (3), the sample period is from 2007m10 to 2008m3. In Column (4), the sample period is from 2007m9 to 2008m4. FA is a continuous variable measuring a firm's share of workers who are paid less than $200 (the monthly minimum wage in 2008) in 2007m12. Post is a dummy variable that equals 1 if after 2008m1 and 0 otherwise. Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

In order to capture the dynamic impact of the minimum wage on firms' employment, we specify the following regression:

$$\ln E_{it} = \alpha_i + \sum_{\tau=2007m5}^{2008m4} \beta_\tau \mathbb{1}\{\tau = t\} \times \text{FA}_i + \gamma_{s(i)t} + \varepsilon_{it} \tag{2}$$

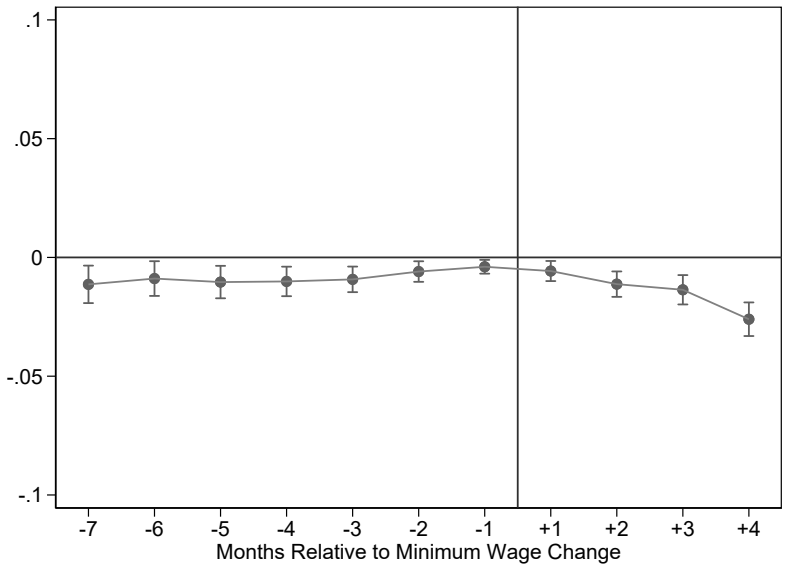
where $\mathbb{1}\{\tau = t\}$ is a dummy variable that equals 1 if the time is t and 0 otherwise. Then, $\{\beta_\tau\}$ for $\tau = \{2007m5, 2007m6, 2007m7, 2007m8, 2007m9, 2007m10, 2007m11\}$ corresponds to pre-trends, and for $\tau = \{2008m1, 2008m2, 2008m3, 2008m4\}$, to dynamic effects relative to the minimum wage event.[21] One more benefit of this approach is that we can easily check the parallel-trend assumption.

Figure 1 presents the results of the dynamics of treatment effects. Starting in the first month after the minimum wage change, employment declines by 0.53 percent. The differences in employment persist and the magnitudes grow throughout the sample period. Quantitatively, the minimum wage reduces firm-level employment by 1.06 percent (after

[21] The coefficient of $2007m12$ will be dropped and hence it will be used as a reference point.

2 months) 1.26 percent (after 3 months), and 2.48 percent (after 4 months). The amplifying result suggests that firms gradually adjust their workforces in response to the minimum wage change. We traced the pre-trend coefficients further back to May 2007 and found no detectable differences in the *trend* behavior of treatment and control firms in the months prior to the minimum wage change. While the pre-trend coefficients exhibit a stable trajectory, one might argue that those coefficients are all negative relative to the reference month (December 2007). This can happen if firms with a higher share of workers subject to the binding minimum wage are more likely to hire seasonal/temporary workers in December. To alleviate this concern, we re-define the variable FA_i based on the information on 2007m11 (or 2007m10) and re-estimate the coefficients in equation (2). Appendix Tables A.3 and A.4 present the estimation results using November 2007 and October 2007, respectively. Reassuringly, the trend behaviors show a very similar pattern to the pattern in Figure 1. Although there is no formal test of the parallel-trend assumption, this pattern can alleviate concerns regarding pre-existing trends at the treated firms.

Figure 1: Dynamics of Treatment Effects, 2007M5 - 2008M4



Notes: The figure displays the treatment effects on employment relative to the month of the minimum wage event by estimating equation (2). The dependent variable is the log of the total number of formal workers. Regressions include firm and industry-time fixed effects. Standard errors are clustered at the firm level. 95% confidence intervals are displayed. The sample period is from 2007m5 to 2008m4.

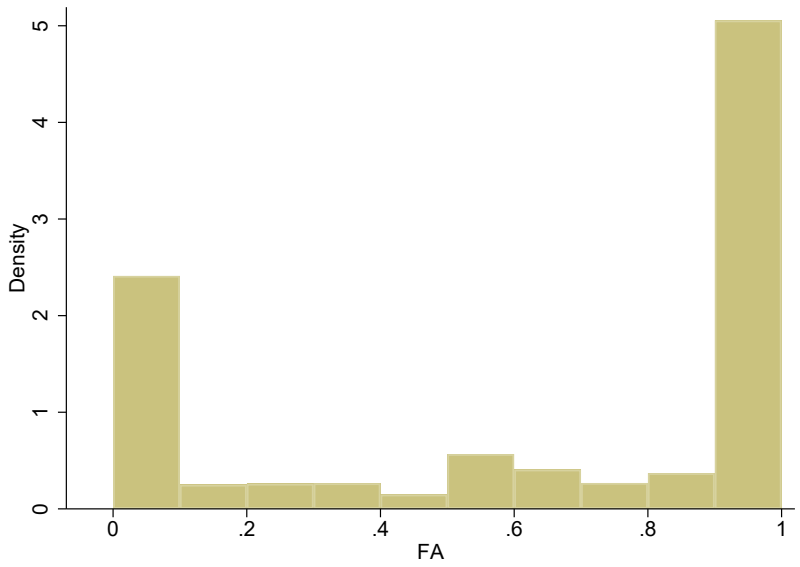
4.2 Dummy Treatment

Instead of using a continuous measure of treatment, we define $\mathbb{1}\{> x\%$ rule$\}_i$ that equals one if a firm i's share of workers who receive less than \$200 is equal to or greater than $x\%$ in 2007m12 and 0 otherwise. Then, we estimate the impact of the minimum wage on employment by specifying the following regression:

$$\ln E_{it} = \alpha_i + \beta \, \mathbb{1}\{> x\% \text{ rule}\}_i \times \text{Post}_t + \gamma_{s(i)t} + \varepsilon_{it}. \tag{3}$$

The coefficient β captures the impact of the minimum wage on a firm's employment during the post-treatment period by comparing treated firms and control firms after controlling for unobserved firm and industry by time fixed effects.

Figure 2: Firm-Level Distribution of FA



Notes: The figure displays the firm-level distribution of the FA variable, which is defined as a firm's share of workers who are paid less than \$200 (the monthly minimum wage in 2008) in 2007m12. The number of bins is set to 10. The total number of observations is 65,712.

Figure 2 shows the firm-level distribution of the FA variable (i.e., firm i's share of workers who are paid less than \$200, the monthly minimum wage in 2008, in 2007m12). The density function exhibits a bimodal distribution. The majority of firms (32,594 out of 65,712 firms, 50%) have workers who all receive less than \$200. The second largest group (14,029 out of 65,712 firms, 21%) is firms in which all workers receive equal to or more than \$200. The remaining firms (19,089 out of 65,712 firms, 29%) have both workers who receive less than \$200 and workers who receive equal to or more than \$200. Since

the share of workers receiving less than the binding minimum wage in the remaining firms can take any value between 0 and 100%, we have to choose a cutoff $x\%$ according to our own discretion. Hence, we first define a cutoff of 50% in which firms with $x \in [0, 50]$ percent share of minimum wage-eligible workers are classified as the control group; while firms with $x \in (50, 100]$ percent share of minimum wage-eligible workers are classified as the treatment group. Then we complement results of the 50% cutoff with results from the different cutoff levels.

Table 5: Dummy Treatment Results

	Dependent Variable: Log of Employment			
Sample	+/- 1m	+/- 2m	+/- 3m	+/- 4m
	(1)	(2)	(3)	(4)
$\mathbb{1}\{> 50\%$ rule$\} \times$ Post	-0.004**	-0.005**	-0.005**	-0.007***
	(0.002)	(0.002)	(0.002)	(0.002)
Fixed Effects:				
Firm	Yes	Yes	Yes	Yes
Industry-Time	Yes	Yes	Yes	Yes
Observations	130,456	260,959	388,631	514,308
R-squared	0.993	0.987	0.981	0.976

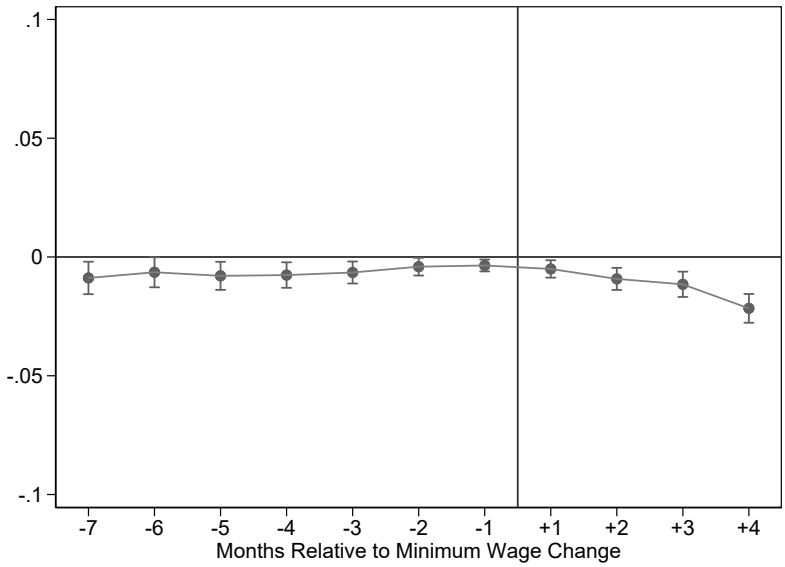
Notes: The dependent variable is the log of the total number of formal workers. In Column (1), the sample period is from 2007m12 to 2008m1. In Column (2), the sample period is from 2007m11 to 2008m2. In Column (3), the sample period is from 2007m10 to 2008m3. In Column (4), the sample period is from 2007m9 to 2008m4. $\mathbb{1}\{> 50\%$ rule$\}$ is a dummy variable that equals one if a firm's share of workers who receive less than \$200 (the monthly minimum wage in 2008) in 2007m12 is equal to or greater than 50% and 0 otherwise. Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

Table 5 reports our dummy treatment results based on the 50% cutoff. Reassuringly, the treatment effects are almost unchanged. Quantitatively, the minimum wage reduces employment of the treated group (firms in which more than 50% of workers must be paid the new minimum wage) by 0.4 percent relative to the control group (firms in which 50% or less of workers must be paid the new minimum wage) in column (1) where the sample period is from 2007m12 to 2008m1. The treatment effect increases as the sample period becomes larger (0.5, 0.5, and 0.7 percent, respectively, in columns (2), (3), and (4)).

Figure 3 presents the results of the dynamics of treatment effects. The results are almost unchanged from our baseline result in Figure 1. In Appendix Tables A.5 and A.6,we use different reference months, November and October, and find that the trend behaviors exhibit a similar pattern, as in Figure 3. Again, we cannot identify a violation of the pre-trend assumption. Starting in the first month after the minimum wage change, employment declines by 0.47 percent. The differences in employment persist and the

magnitudes grow throughout the sample period. Quantitatively, the binding minimum wage reduces firm-level employment by 0.87 percent (after 2 months), 1.07 percent (after 3 months), and 2.07 percent (after 4 months).

Figure 3: Dynamics of Treatment Effects for Dummy Treatment, 2007M5 - 2008M4



Notes: The figure displays the treatment effects on employment relative to the month of the minimum wage event. The dependent variable is the log of the total number of formal workers. Regressions include firm and industry-time fixed effects. Standard errors are clustered at the firm level. 95% confidence intervals are displayed. The sample period is from 2007m5 to 2008m4.

Panel A of Table 6 reports the dummy treatment results when the cutoff is 0% (i.e., firms with at least one minimum wage-eligible worker are classified as a treatment group). Reassuringly, all coefficients are negative and statistically significant at the 1 percent level. Quantitatively, the minimum wage reduces employment among the treated group (firms with at least one minimum wage-eligible worker) by 1.7 percent relative to the control group (i.e., firms with no minimum wage-eligible workers) in column (1) where the sample period is from 2007m12 to 2008m1. The treatment effects increase and then decrease as the sample period becomes larger (1.9, 1.8, and 1.7 percent, respectively, in columns (2), (3), and (4)). The magnitude of the treatment effects is larger than in our previous results, shown in Table 5. This suggests that firms with $x \in (0, 50]$ percent share of minimum wage workers react differently in response to the minimum wage increase than firms with no minimum wage-eligible workers.

We thus further explore whether the negative employment impact of the minimum wage is magnified as the share of workers earning less than the minimum wage increases.

Table 6: Additional Dummy Treatment Results

	Dependent Variable: Log of Employment			
Sample	+/- 1m	+/- 2m	+/- 3m	+/- 4m
	(1)	(2)	(3)	(4)
Panel A.				
$\mathbb{1}\{> 0\%$ rule$\} \times$ Post	-0.017***	-0.019***	-0.018***	-0.017***
	(0.005)	(0.004)	(0.004)	(0.005)
Panel B.				
$\mathbb{1}\{x \in (0, 10]\} \times$ Post	-0.022***	-0.019***	-0.010	-0.003
	(0.006)	(0.006)	(0.007)	(0.008)
$\mathbb{1}\{x \in (10, 20]\} \times$ Post	-0.025***	-0.029***	-0.025***	-0.019***
	(0.006)	(0.007)	(0.007)	(0.007)
$\mathbb{1}\{x \in (20, 30]\} \times$ Post	-0.031***	-0.036***	-0.036***	-0.032***
	(0.006)	(0.006)	(0.007)	(0.007)
$\mathbb{1}\{x \in (30, 40]\} \times$ Post	-0.023***	-0.030***	-0.030***	-0.029***
	(0.006)	(0.006)	(0.007)	(0.008)
$\mathbb{1}\{x \in (40, 50]\} \times$ Post	-0.020***	-0.024***	-0.021***	-0.019***
	(0.004)	(0.004)	(0.005)	(0.005)
$\mathbb{1}\{x \in (50, 60]\} \times$ Post	-0.039***	-0.046***	-0.052***	-0.055***
	(0.008)	(0.010)	(0.012)	(0.014)
$\mathbb{1}\{x \in (60, 70]\} \times$ Post	-0.033***	-0.036***	-0.035***	-0.034***
	(0.005)	(0.005)	(0.006)	(0.006)
$\mathbb{1}\{x \in (70, 80]\} \times$ Post	-0.029***	-0.031***	-0.030***	-0.029***
	(0.005)	(0.006)	(0.006)	(0.007)
$\mathbb{1}\{x \in (80, 90]\} \times$ Post	-0.031***	-0.035***	-0.033***	-0.030***
	(0.005)	(0.006)	(0.006)	(0.007)
$\mathbb{1}\{x \in (90, 100]\} \times$ Post	-0.011***	-0.013***	-0.012***	-0.013***
	(0.002)	(0.003)	(0.003)	(0.003)
Fixed Effects:				
Firm	Yes	Yes	Yes	Yes
Industry-Time	Yes	Yes	Yes	Yes
Observations	130,456	260,959	388,631	514,308
R-squared	0.993	0.987	0.981	0.976

Notes: The dependent variable is the log of the total number of formal workers. In Column (1), the sample period is from 2007m12 to 2008m1. In Column (2), the sample period is from 2007m11 to 2008m2. In Column (3), the sample period is from 2007m10 to 2008m3. In Column (4), the sample period is from 2007m9 to 2008m4. $\mathbb{1}\{> 0\%$ rule$\}$ is a dummy variable that equals one if a firm's share of workers who receive less than \$200 (the monthly minimum wage in 2008) in 2007m12 is greater than 0% and 0 otherwise. $\mathbb{1}\{x \in (a, b]\}$ is a dummy variable that equals one if a firm's share of workers who receive less than \$200 in 2007m12 is between $a\%$ and $b\%$ and 0 otherwise. Post is a dummy variable that equals 1 if after 2008m1 and 0 otherwise. Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

We divide the treatment group into ten bins, each with a range of 10 percentage points. For instance, the first group dummy, $\mathbb{1}\{x \in (0, 10]\}$, is defined such that it equals one if a firm's share of workers earning less than \$200 (the monthly minimum wage in 2008) in 2007m12 is greater than 0 percent and equal to or less than 10 percent. Panel B of Table 6

shows that all coefficients are negative. However, we do not find any systematic relationship between employment and the share of minimum wage workers in the treatment group. Therefore the main reduction in employment results from the difference between firms with at least one minimum wage worker and firms with no minimum wage-eligible workers.

4.3 Event Study

One disadvantage of the previous difference-in-differences (DID) estimation strategy is that the treatment effect is identified as the difference between a control group and a treatment group. Meer and West (2016) argue that the minimum wage would impact employment over time through changes in growth rather than cause an immediate drop in relative employment levels. Hence, it would also be interesting to investigate whether the minimum wage change reduced employment in the treated firms or merely slowed the growth rate of employment in the treated firms. In order to answer this question, we design the following event study and estimate the equation for the treatment group, $\mathbb{1}\{> 50\%$ rule$\}$, and for the control group, $\mathbb{1}\{\leq 50\%$ rule$\}$, separately.

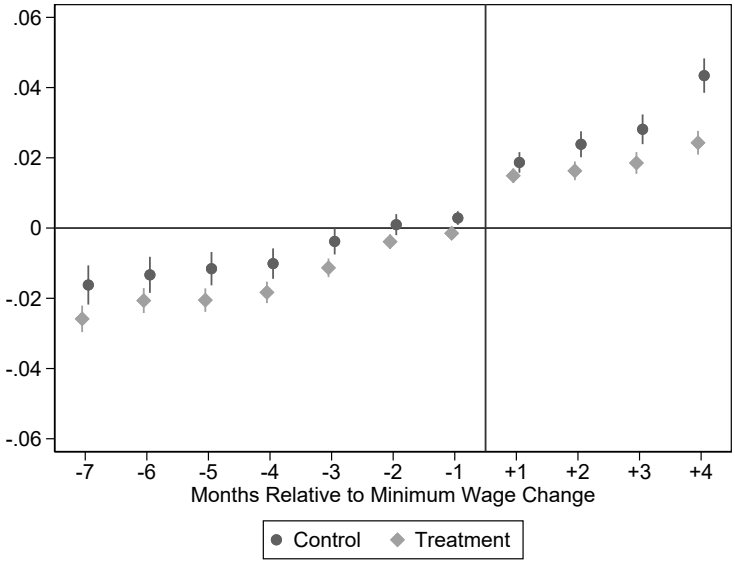
$$\ln E_{it} = \alpha_i + \sum_{\tau=2007m5}^{2008m4} \beta_\tau \mathbb{1}\{\tau = t\} + \varepsilon_{it}. \tag{4}$$

Figure 4 presents the event study results. The dynamic coefficients for the treatment group show that, starting in the first month after the minimum wage change, employment increases by 1.46 percent relative to 2007m12. The coefficient slightly increases to 1.58 percent (after 2 months), 1.80 percent (after 3 months), and 2.36 percent (after 4 months). For the control group, the coefficients are 1.81 percent (after 1 months), 2.29 percent (after 2 months), 2.68 percent (after 3 months), and 4.18 percent (after 4 months). In Appendix Tables A.7 and A.8, we use different reference months, November and October, and find that the trend behaviors exhibit a similar pattern as in Figure 4. Therefore the minimum wage slowed the growth rate of employment in the treated firms, but did not reduce their absolute number of employees.

4.4 Job Separations and New Hires

Our investigations so far have identified the negative employment impacts of the minimum wage hike. We further investigate whether continuing firms (i.e., those that existed in 2007M12 and in subsequent periods) may have changed the composition of their labor

Figure 4: Event Study Result, 2007M5 - 2008M4



Notes: The figure displays the coefficients of the employment relative to the month of the minimum wage event by estimating equation (4) separately for the treatment group, $\mathbb{1}\{> 50\%$ rule$\}$, and for the control group, $\mathbb{1}\{\leq 50\%$ rule$\}$. The dependent variable is the log of the total number of formal workers. Regressions include firm fixed effects. Standard errors are clustered at the firm level. 95% confidence intervals are displayed. The sample period is from 2007m5 to 2008m4.

force by dismissing existing workers or reducing new hires following the increase in the minimum wage. Previous studies have found a negative effect of a binding minimum wage on both separations and hires (see Portugal and Cardoso, 2006; Brochu and Green, 2013; Dube, Lester and Reich, 2016). First, we model the job separations in continuing firms by specifying the following regression:

$$JS_{it} = \alpha + \beta \text{FA}_{i,2007M12} + \gamma X_{i,2007M12} + \delta_{s(i),2007M12} + \varepsilon_{it} \tag{5}$$

where i denotes a firm, s means industry, and t indicates time. The time t ranges from 2008M1 to 2008M4. We separately estimate the above equation by time period. The dependent variable, JS_{it}, denotes the rate of job separation for firm i in time t, which is defined as the fraction of employed workers in 2007M12 that become separated from their jobs in time t. $\text{FA}_{i,2007M12}$ is defined as firm i's share of workers who earn less than \$200 in 2007m12. $X_{i,2007M12}$ is the total number of workers for firm i in time t. $\delta_{s(i),2007M12}$ is industry fixed effects. Standard errors are clustered at the industry level. The coefficient β means the impact of the minimum wage on the firm's job separation rate after controlling for firm size and industry fixed effects.

In Table 7, we provide our job separation results, showing the impact of the minimum wage on the job separation rate from 2008M1 to 2008M4. In Panel A, we show that the minimum wage leads to a statistically significant 0.5 percentage point increase in the separation rate for treated firms relative to control firms with no minimum wage-eligible workers after one month. The treatment effects are 0.8 percent (after two months), 1.1 percent (after three months), and 1.2 percent (after four months), respectively. In Panels B and C, we use dummy treatments and find similar results.

We then model the new hires in continuing firms by specifying the following regression:

$$NH_{it} = \alpha + \beta \text{FA}_{i,2007M12} + \gamma X_{i,2007M12} + \delta_{s(i),2007M12} + \varepsilon_{it} \tag{6}$$

The dependent variable, NH_{it}, denotes the rate of new hiring for firm i in time t, which is defined as the fraction of employed workers in time t that are newly hired in time t after 2007m12. The coefficient β means the impact of the minimum wage on the firm's new hiring rate after controlling for firm size and industry fixed effects.

In Table 8, we provide our new hires results, showing the impact of the minimum wage on the hiring rate from 2008M1 to 2008M4. In Panel A, we find that the minimum wage leads to a statistically significant 0.5 percentage point decrease in the hiring rate for treated firms relative to control firms after one month. The treatment effects are 0.8 percent (after two months), 1.0 percent (after three months), and 1.7 percent (after four months), respectively. In Panels B and C, we use dummy treatments and find similar results.

Our estimation results indicate that Ecuadorian firms adjusted their labor force composition by both laying off existing workers and slowing new hires after the minimum wage hike. The estimation results on separation are at odds with the findings in Portugal and Cardoso (2006), Brochu and Green (2013), and Dube, Lester and Reich (2016) using Portugal, Canada, and U.S. datasets, respectively; they found a sizable decline in separation rates after minimum wage increases. However, our estimation results on hiring rates are in line with findings in their studies. The different result on the impact of minimum wage on separation rates may result from different identification strategies: we rely on 64,344 heterogeneous Ecuadorian firms that have different shares of workers to whom they are required to pay the minimum wage. Or it may be that previous studies focused on teenagers or a particular industry, whereas we focus on all workers in the formal sector.

Table 7: Job Separation Results

	Dependent Variable: JS_{it}			
Sample	2008M1	2008M2	2008M3	2008M4
	(1)	(2)	(3)	(4)
Panel A.				
$FA_{i,2007M12}$	0.005***	0.008***	0.011***	0.012***
	(0.001)	(0.002)	(0.003)	(0.004)
Observations	64,344	63,587	62,890	62,272
R-squared	0.027	0.053	0.069	0.078
Panel B.				
$\mathbb{1}\{> 0\%$ rule$\}$	0.006***	0.010***	0.013***	0.014***
	(0.001)	(0.001)	(0.003)	(0.003)
Observations	64,344	63,587	62,890	62,272
R-squared	0.028	0.054	0.069	0.079
Panel C.				
$\mathbb{1}\{> 50\%$ rule$\}$	0.003***	0.006***	0.008**	0.008**
	(0.001)	(0.002)	(0.003)	(0.003)
Observations	64,344	63,587	62,890	62,272
R-squared	0.027	0.053	0.068	0.078
Fixed Effects:				
Industry	Yes	Yes	Yes	Yes
Firm Size	Yes	Yes	Yes	Yes

Notes: The dependent variable is the rate of job separation for firm i in time t, which is defined as the fraction of employed workers in 2007M12 that become separated from their jobs in time t. $FA_{i,2007M12}$ is a continuous variable measuring a firm's share of workers who receive less than \$200 dollars (the monthly minimum wage in 2008) in 2007m12. $D_{i,2007M12}$ is defined as a dummy variable that equals one if worker i less than \$200 in 2007m12 and zero otherwise. $\mathbb{1}\{> x\%$ rule$\}$ is a dummy variable that equals one if a firm's share of workers who receive less than 200 dollars (i.e., minimum wage in the year 2008) in 2007m12 is greater than $x\%$ and 0 otherwise. Standard errors are clustered at the industry level. *** p<0.01, ** p<0.05, * p<0.1.

4.5 Industry Heterogeneity

We estimate our baseline equation (1) by industry.[22] Tables B.3, B.4, and B.5 report the estimation results. We do not find any positive coefficients with statistical significance across all industries and horizons. Next, we identify three out of eleven industries that report negative employment effects of the minimum wage. Those three industries are Agriculture, Hunting, Forestry and Fishing (code 1), Manufacturing (code 3), and Electricity, Gas and Water (code 4). In column (4) of Tables B.3, B.4, and B.5, the treatment effects are 3.8 percent (code 1), 3.2 percent (code 3), and 9.6 percent (code 4), respectively. The mag-

[22]There are 11 selected industries in the dataset (see Appendix Table B.1). Please refer to Section 3 for more details about the industry selection.

Table 8: New Hires Results

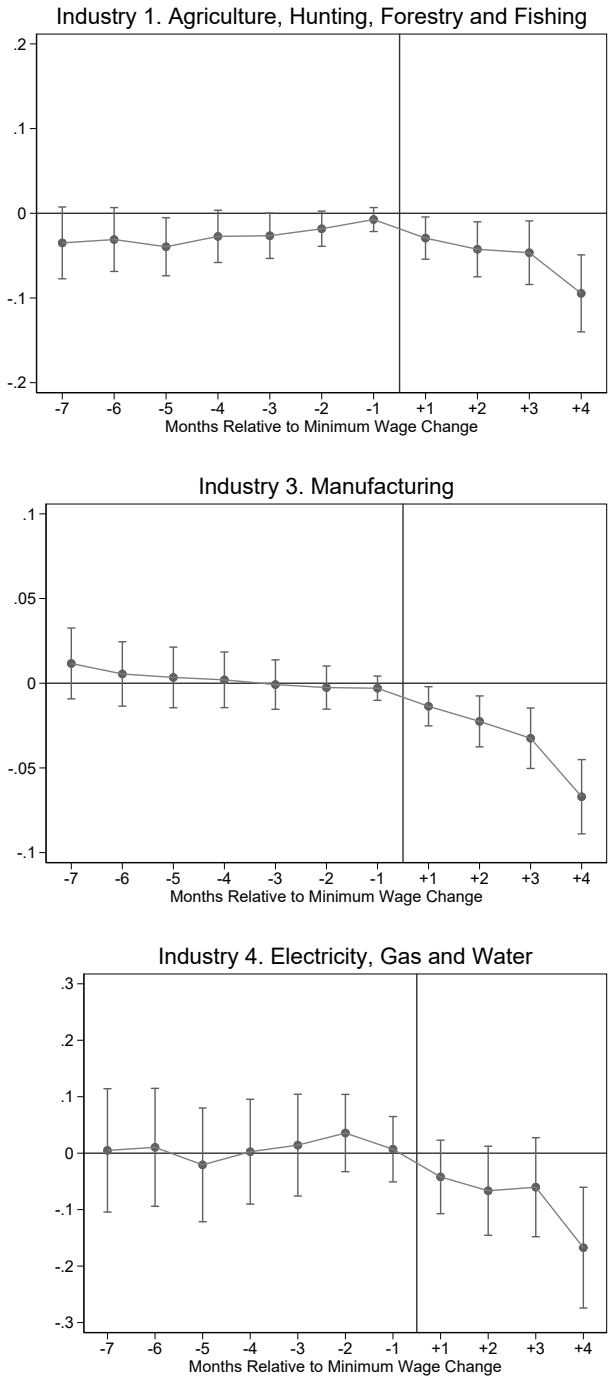
	Dependent Variable: NH_{it}			
Sample	2008M1	2008M2	2008M3	2008M4
	(1)	(2)	(3)	(4)
Panel A.				
$FA_{i,2007M12}$	-0.005**	-0.008**	-0.010**	-0.017***
	(0.002)	(0.003)	(0.004)	(0.005)
Observations	64,344	63,587	62,890	62,272
R-squared	0.009	0.018	0.024	0.033
Panel B.				
$\mathbb{1}\{> 0\%$ rule$\}$	-0.003**	-0.006**	-0.006*	-0.012**
	(0.001)	(0.002)	(0.003)	(0.004)
Observations	64,344	63,587	62,890	62,272
R-squared	0.009	0.017	0.024	0.032
Panel C.				
$\mathbb{1}\{> 50\%$ rule$\}$	-0.004**	-0.007***	-0.009**	-0.014***
	(0.001)	(0.002)	(0.003)	(0.004)
Observations	64,344	63,587	62,890	62,272
R-squared	0.009	0.018	0.024	0.033
Fixed Effects:				
Industry	Yes	Yes	Yes	Yes
Firm Size	Yes	Yes	Yes	Yes

Notes: The dependent variable is the rate of new hiring for firm i in time t, which is defined as the fraction of employed workers in time t that are newly hired in time t after 2007m12. $FA_{i,2007M12}$ is a continuous variable measuring a firm's share of workers who receive less than \$200 dollars (the monthly minimum wage in 2008) in 2007m12. $D_{i,2007M12}$ is defined as a dummy variable that equals one if worker i less than \$200 dollars in 2007m12 and zero otherwise. $\mathbb{1}\{> x\%$ rule$\}$ is a dummy variable that equals one if a firm's share of workers who receive less than 200 dollars (i.e., minimum wage in the year 2008) in 2007m12 is greater than $x\%$ and 0 otherwise. Standard errors are clustered at the industry level. *** p<0.01, ** p<0.05, * p<0.1.

nitude of the treatment effect becomes larger as the sample size increases. To check the dynamics of the treatment effects, we estimate equation (2) by industry. In Figure 5, we could not identify any differential pre-trends before the minimum wage change. After the minimum wage change, the treatment effect grows throughout the sample period.

Our finding is closer to those in Dube (2013). Using the Business Dynamics Statistics and the Quarterly Census of Employment and Wages datasets in the U.S., Dube (2013) found that a negative association between minimum wages and aggregate employment growth is particularly strong in manufacturing but that there is no such association in retail or in accommodation and food services.

Figure 5: Dynamics of Treatment Effects by Industry



Notes: Each figure displays the treatment effects on the employment relative to the month of the minimum wage event. The dependent variable is the log of the total number of formal workers. Regressions include firm and time fixed effects. Standard errors are clustered at the firm level. 95% confidence intervals are displayed. The sample period is from 2007m5 to 2008m4.

5 Worker-Level Results

5.1 Employment Effects

We estimate the worker-level impact of the minimum wage on employment by specifying the following regression:

$$\Delta E_{it} = \alpha + \beta \mathrm{D}_{i,2007M12} + \gamma X_{i,2007M12} + \delta_{j(i),2007M12} + \varepsilon_{it} \tag{7}$$

where i denotes a worker, j means a firm, and t indicates time. The time t ranges from 2008M1 to 2008M4. We separately estimate the above equation by time period. The dependent variable, ΔE_{it}, denotes the change in employment status of worker i between the periods 2007M12 and t (i.e., E_{it} is a dummy variable that equals one if employed and zero otherwise). In 2007M12, all workers in the sample were employed (i.e., $E_{i,2007M12} = 1$).[23] We track those individuals over time and assign a dummy variable that equals zero if those workers are no longer in the dataset. $\mathrm{D}_{i,2007M12}$ is defined as a dummy variable that equals one if worker i's wage is less than \$200 dollars in 2007m12 and zero otherwise. $X_{i,2007M12}$ is a vector of individual characteristics such as age and gender. $\delta_{j(i),2007M12}$ is firm fixed effects. Standard errors are clustered at the firm level. Our main coefficient of interest, β, captures the impact of the minimum wage on employment status in time t after controlling for worker characteristics and firm fixed effects.

One might argue that workers who receive higher wages are more likely to be employed (i.e., there is lower turnover among high-wage workers). Hence, our main coefficient might be compounded by this effect rather than by the minimum wage increase. To alleviate this concern, we also include the log wage of workers in 2007M12 as a worker characteristic in the above specification. Next, instead of adding the initial log wage variable, we confine our analysis to workers who are paid equal to or just above the minimum wage and workers who are paid just below the minimum wage. This estimation framework is similar to a regression discontinuity design by which we compare observations that lie close to each side of the threshold.

Panel A of Table 9 presents the results of estimating equation (7). Starting in the first month after the minimum wage change, treated workers have a 2.2 percentage point lower probability of remaining employed than control workers after controlling for individual characteristics (age, gender, and income) and firm fixed effects. The differences in the probability of remaining employed persist, and the magnitudes grow throughout

[23] We cannot separately observe individuals who are unemployed, not in the labor force, or in the informal sector.

the sample period. Quantitatively, the minimum wage reduces worker-level employment status by 3.3 percentage points (after 2 months), 3.7 percentage points (after 3 months), and 3.9 percentage points (after 4 months). The result reconfirms the firm-level finding. In Panels B and C of Table 9, additional worker-level estimation results are presented. Although the magnitudes are slightly smaller, the results remain the same.

Table 9: Worker-Level Employment Results, Baseline

	Dependent Variable: ΔE_{it}			
Sample	2008M1	2008M2	2008M3	2008M4
	(1)	(2)	(3)	(4)
Panel A. All workers				
$D_{i,2007M12}$	-0.021***	-0.031***	-0.035***	-0.036***
	(0.003)	(0.004)	(0.005)	(0.005)
Observations	704,139	704,132	704,130	704,132
R-squared	0.227	0.244	0.246	0.242
Panel B. Workers with $\log(\text{wage})_{i,2007M12} \in [185, 215]$				
$D_{i,2007M12}$	-0.015***	-0.029***	-0.030***	-0.031***
	(0.003)	(0.005)	(0.005)	(0.005)
Observations	64,904	64,900	64,902	64,912
R-squared	0.273	0.289	0.281	0.274
Panel C. Workers with $\log(\text{wage})_{i,2007M12} \in [190, 210]$				
$D_{i,2007M12}$	-0.016***	-0.030***	-0.034***	-0.035***
	(0.003)	(0.005)	(0.006)	(0.005)
Observations	47,578	47,574	47,582	47,583
R-squared	0.303	0.313	0.301	0.292
Fixed Effects:				
Firm	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes

Notes: The dependent variable is the change in employment status of worker i between periods 2007M12 and t. $D_{i,2007M12}$ is defined as a dummy variable that equals one if worker i earns less than \$200 (the monthly minimum wage in 2008) in 2007m12 and zero otherwise. In Panel A, individual controls include age, gender, and log of wages in 2007M12. In Panels B and C, individual controls include age and gender. Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

5.2 Heterogeneous Employment Effects

We then explore whether the negative employment impacts differ across age groups by estimating the following regression:

$$\Delta E_{it} = \alpha + \beta_1 D_{i,2007M12} + \beta_2 D_{i,2007M12} \times \mathbb{1}\{age \in (0,25)\} + \beta_3 D_{i,2007M12} \times \mathbb{1}\{age \in [55,65)\} + \beta_4 D_{i,2007M12} \times \mathbb{1}\{age \in [65,\infty)\} + \gamma X_{i,2007M12} + \delta_{j(i),2007M12} + \varepsilon_{it} \quad (8)$$

where $\mathbb{1}\{age \in (0, 25)\}$ is a dummy variable that equals one if the worker's age is under 25 and zero otherwise. The coefficient β_1 captures the impact of the minimum wage on employment status in time t for workers aged 25 to 54 (those in their prime working lives) after controlling for worker characteristics and firm fixed effects. The coefficients β_2, β_3, and β_4 measure differential impacts for workers aged 0 to 25, 55 to 64, and 65 or more, respectively, relative to the reference group, 25 to 54.

In Panel A of Table 10, young workers below age 25 have a lower 0.9 to 1.8 percentage point lower probability of remaining employed than the prime working age group. Workers age 55 and older have a 0.9 to 3.1 percentage point higher probability of remaining employed than the prime working-age group. In Panels B and C of Table 10, we confine our sample to workers who are paid equal to or just above the minimum wage and workers who are paid just below the minimum wage. Workers under age 25 still have a lower probability of remaining employed; while we found no differential effects for workers age 55 and older relative to the prime working-age group. While previous studies found contradictory employment impacts for younger and less-skilled workers (e.g., Card, 1992; Neumark and Wascher, 1992; Neumark et al., 2014; Allegretto et al., 2017), we detect a short-run negative employment effect for young workers using the high-quality Ecuadorian monthly data.

We further ask whether the negative employment impacts differ across males and females by specifying the following regression:

$$\Delta E_{it} = \alpha + \beta_1 \mathrm{D}_{i,2007M12} + \beta_2 \mathrm{D}_{i,2007M12} \times F_i + \gamma X_{i,2007M12} + \delta_{j(i),2007M12} + \varepsilon_{it} \qquad (9)$$

where F_i is a dummy variable that equals one if worker i's gender is female and zero otherwise. The coefficient β_2 captures differential employment impact for men and women.

In Panel A of Table 11, female workers have a 0.9 to 1.1 percentage point higher probability of remaining employed than male workers. For limited samples (i.e., Panels B and C of Table 11), we found no differential effects for male and female workers.

Table 10: Worker-Level Employment Results, Age Heterogeneity

	Dependent Variable: ΔE_{it}			
Sample	2008M1	2008M2	2008M3	2008M4
	(1)	(2)	(3)	(4)
Panel A. All workers				
$D_{i,2007M12}$	-0.019***	-0.028***	-0.032***	-0.034***
	(0.003)	(0.004)	(0.004)	(0.004)
$D_{i,2007M12} \times \mathbb{1}\{age \in (0,25)\}$	-0.009***	-0.016***	-0.018***	-0.017***
	(0.003)	(0.004)	(0.005)	(0.005)
$D_{i,2007M12} \times \mathbb{1}\{age \in [55,64)\}$	0.014***	0.023***	0.027***	0.031***
	(0.002)	(0.003)	(0.004)	(0.004)
$D_{i,2007M12} \times \mathbb{1}\{age \in [65,\infty)\}$	0.009**	0.022***	0.027***	0.024***
	(0.004)	(0.007)	(0.008)	(0.008)
Observations	704,139	704,132	704,130	704,132
R-squared	0.226	0.243	0.245	0.240
Panel B. Workers with log(wage)$_{i,2007M12} \in [185,215]$				
$D_{i,2007M12}$	-0.011***	-0.023***	-0.023***	-0.025***
	(0.003)	(0.004)	(0.005)	(0.005)
$D_{i,2007M12} \times \mathbb{1}\{age \in (0,25)\}$	-0.013***	-0.021***	-0.023***	-0.021**
	(0.005)	(0.007)	(0.008)	(0.008)
$D_{i,2007M12} \times \mathbb{1}\{age \in [55,64)\}$	0.001	-0.001	-0.001	-0.002
	(0.006)	(0.009)	(0.011)	(0.012)
$D_{i,2007M12} \times \mathbb{1}\{age \in [65,\infty)\}$	0.008	0.009	0.012	0.014
	(0.015)	(0.019)	(0.021)	(0.024)
Observations	64,904	64,900	64,902	64,912
R-squared	0.273	0.289	0.281	0.274
Panel C. Workers with log(wage)$_{i,2007M12} \in [190,210]$				
$D_{i,2007M12}$	-0.013***	-0.023***	-0.027***	-0.029***
	(0.003)	(0.005)	(0.006)	(0.006)
$D_{i,2007M12} \times \mathbb{1}\{age \in (0,25)\}$	-0.011**	-0.024***	-0.025***	-0.019**
	(0.005)	(0.008)	(0.009)	(0.009)
$D_{i,2007M12} \times \mathbb{1}\{age \in [55,64)\}$	-0.002	0.002	0.001	0.009
	(0.008)	(0.011)	(0.013)	(0.014)
$D_{i,2007M12} \times \mathbb{1}\{age \in [65,\infty)\}$	0.003	0.003	0.006	0.012
	(0.017)	(0.022)	(0.024)	(0.027)
Observations	47,578	47,574	47,582	47,583
R-squared	0.303	0.313	0.301	0.292
Fixed Effects:				
Firm	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes

Notes: The dependent variable is the change in employment status of worker i between periods 2007M12 and t. $D_{i,2007M12}$ is defined as a dummy variable that equals one if worker i earns less than \$200 (the monthly minimum wage in 2008) in 2007m12 and zero otherwise. F_i is a female dummy variable. In Panel A, individual controls include age, gender, and log of wages in 2007M12. In Panels B and C, individual controls include age and gender. Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

Table 11: Worker-Level Employment Results, Gender Heterogeneity

	Dependent Variable: ΔE_{it}			
Sample	2008M1	2008M2	2008M3	2008M4
	(1)	(2)	(3)	(4)
Panel A. All workers				
$D_{i,2007M12}$	-0.025***	-0.035***	-0.038***	-0.039***
	(0.004)	(0.005)	(0.005)	(0.005)
$D_{i,2007M12} \times F_i$	0.010***	0.011***	0.010***	0.009**
	(0.003)	(0.003)	(0.004)	(0.004)
Observations	704,139	704,132	704,130	704,132
R-squared	0.226	0.243	0.245	0.240
Panel B. Workers with $\log(\text{wage})_{i,2007M12} \in [185, 215]$				
$D_{i,2007M12}$	-0.018***	-0.025***	-0.024***	-0.023***
	(0.005)	(0.006)	(0.007)	(0.007)
$D_{i,2007M12} \times F_i$	0.001	0.000	0.003	0.002
	(0.004)	(0.008)	(0.008)	(0.008)
Observations	64,904	64,900	64,902	64,912
R-squared	0.273	0.289	0.281	0.274
Panel C. Workers with $\log(\text{wage})_{i,2007M12} \in [190, 210]$				
$D_{i,2007M12}$	-0.018***	-0.025***	-0.019**	-0.019**
	(0.007)	(0.007)	(0.008)	(0.009)
$D_{i,2007M12} \times F_i$	-0.002	-0.002	0.006	0.003
	(0.005)	(0.008)	(0.009)	(0.009)
Observations	47,578	47,574	47,582	47,583
R-squared	0.303	0.313	0.301	0.292
Fixed Effects:				
Firm	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes

Notes: The dependent variable is the change in employment status of worker i between periods 2007M12 and t. $D_{i,2007M12}$ is defined as a dummy variable that equals one if worker i earns less than \$200 (the monthly minimum wage in 2008) in 2007m12 and zero otherwise. F_i is a female dummy variable. In Panel A, individual controls include age, gender, and log of wages in 2007M12. In Panels B and C, individual controls include age and gender. Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

5.3 Wage Effects

We estimate the wage impacts of the minimum wage by specifying the following regression:

$$\%\Delta W_{it} = \alpha + \sum_{b=(-200,-30)}^{[285,300)} \beta_b \mathbb{1}\{b = bin\} + \gamma X_{i,2007M12} + \delta_{s(i),2007M12} + \varepsilon_{it} \tag{10}$$

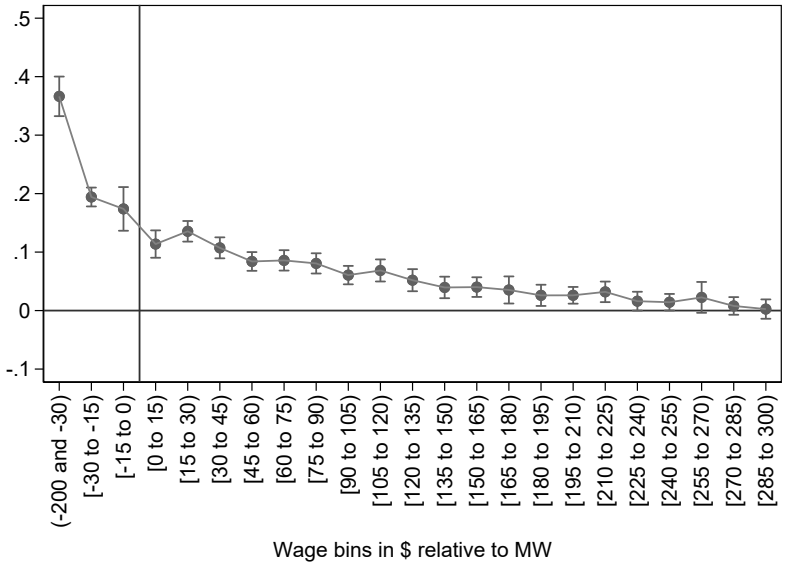
where i denotes a worker, j means a firm, and t indicates time. The time t ranges from 2008M1 to 2008M4. We separately estimate the above equation by time period. The dependent variable, $\%\Delta W_{it}$, denotes the percentage change in the wage of worker i between periods 2007M12 and t. We assign workers to wage bins b based on their monthly wage

in 2007M12. The set of wage bins is defined as follows:

$$\mathbb{B} = \{(-200, -30), [-30, -15), [-15, 0), [0, 15), [15, 30), ..., [270, 285), [285, 300), [300, \infty)\}$$

The definition implies that 0 represents \$200 (the monthly minimum wage in 2008). The length of each bin is set to \$15, except for the two extremes of the wage distribution: $(-200, -30)$ and $[300, \infty)$. The first wage bin, $(-200, -30)$, refers to a group of workers who receive less than the 2007 minimum wage (i.e., \$170); the second wage bin, $[300, \infty)$, refers to a group of workers who receive equal to or more than \$500. In the regression, the dummy variable for $[300, \infty)$ is dropped and used as a reference group that is unlikely to be affected by the minimum wage hike. $X_{i,2007M12}$ is a vector of individual characteristics such as age and gender. $\delta_{s(i),2007M12}$ is industry fixed effects.[24] Standard errors are clustered at the firm level.

Figure 6: The Wage Effects of the Minimum Wage



Notes: The figure displays the percentage change in the monthly wage growth of workers in each bin from 2007m12 to 2008m1 relative to the group of workers who are in the wage bin $[300, \infty)$, after controlling for individual characteristics such as age, gender, and industry fixed effects (see equation (10)). Standard errors are clustered at the firm level. 95% confidence intervals are displayed. The wage bins are defined in dollars relative to the minimum wage in 2008. Hence, 0 on vertical line represents \$200.

Figure 6 shows the estimation results of equation (10) for $t = 2008m1$. We report wage changes between 2007m12 and 2008m1 for each wage bin (b). First, we find that wage growth for the control group (workers who receive equal to or more than \$500) was 3.9

[24] We also estimate equation (10) using firm fixed effects $\delta_{j(i),2007M12}$. In this case, the interpretation of main coefficients is within-firm wage changes in response to the minimum wage hike.

percent. All the coefficients represent wage growth relative to the control group. Second, workers who receive less than the 2008 monthly minimum wage, $200, experience higher monthly wage growth than workers who receive equal to or more than the 2008 minimum wage.[25] The coefficients range from 17.4 to 36.6 percent for the three wage bins that are located to the left of the minimum wage; while the coefficients range from 0.0 to 13.6 percent for the wage bins that are located to the right of the minimum wage. Note also that the minimum wage was in the 35th percentile of the wage distribution and hence the size of wage increase was substantial for Ecuadorian firms. This finding implies that the minimum wage helps reduce wage inequality by raising wages for low-paid workers relatively more than for high-paid workers. Third, we identify the wage spillover effect resulting from the minimum wage increase. Using the U.S. Current Population Survey Merged Outgoing Rotation Group (CPS MORG) from 1979-2012, Autor, Manning and Smith (2016) find that the wage effects extend to percentiles where the minimum is non-binding. However, due to measurement error in the survey data, they were unable to uncover the *true spillover effects*. We find that wage spillovers are effectively non-zero—i.e., the coefficients are statistically significant at the 1 percent level up to the 77th percentile of the wage distribution. About 42 percent of the workforce—i.e. the 35th percentile to the 77th percentile—experience wage spillovers that range from 2.6 percent to 13.6 percent. Generally, the spillover effects decay as wage rises.

In Panel A of Table 12, detailed estimation results using industry fixed effects are presented for the period 2008M1 to 2008M4. Our core findings are robust across columns. In Panel B of Table 12, we include firm fixed effects instead of industry fixed effects to estimate within-firm wage changes in response to the minimum wage hike. Generally, the coefficients become larger, but all the core findings stand.

[25] Dustmann et al. (2020) find a similar pattern in their study of the German minimum wage. We go further by using Ecuadorian monthly administrative data that provide a precise measure of the monthly wage, instead of a proxied hourly wage. In addition, our data frequency is monthly instead of yearly.

Table 12: The Wage Effects of the Minimum Wage Increase

	Dependent Variable: $\%\Delta W_{it}$							
Model	*Panel A.* Industry FEs Model				*Panel B.* Firm FEs Model			
Sample	2008M1	2008M2	2008M3	2008M4	2008M1	2008M2	2008M3	2008M4
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$(-200, -30)$	0.366***	0.401***	0.369***	0.383***	0.496***	0.511***	0.511***	0.520***
	(0.017)	(0.020)	(0.021)	(0.025)	(0.028)	(0.029)	(0.033)	(0.072)
$[-30, -15)$	0.194***	0.216***	0.189***	0.224***	0.296***	0.321***	0.309***	0.460***
	(0.008)	(0.009)	(0.010)	(0.023)	(0.020)	(0.021)	(0.013)	(0.107)
$[-15, 0)$	0.174***	0.183***	0.150***	0.154***	0.234***	0.231***	0.235***	0.325***
	(0.019)	(0.010)	(0.013)	(0.016)	(0.025)	(0.014)	(0.013)	(0.059)
$[0, 15)$	0.114***	0.126***	0.102***	0.123***	0.175***	0.187***	0.192***	0.284***
	(0.012)	(0.010)	(0.012)	(0.013)	(0.014)	(0.013)	(0.011)	(0.054)
$[15, 30)$	0.136***	0.131***	0.112***	0.122***	0.177***	0.173***	0.176***	0.249***
	(0.009)	(0.009)	(0.011)	(0.011)	(0.012)	(0.012)	(0.011)	(0.049)
$[30, 45)$	0.107***	0.101***	0.084***	0.092***	0.144***	0.140***	0.148***	0.206***
	(0.009)	(0.009)	(0.012)	(0.011)	(0.010)	(0.011)	(0.011)	(0.044)
$[45, 60)$	0.084***	0.087***	0.075***	0.086***	0.126***	0.128***	0.137***	0.202***
	(0.008)	(0.008)	(0.011)	(0.009)	(0.009)	(0.011)	(0.010)	(0.046)
$[60, 75)$	0.086***	0.079***	0.062***	0.070***	0.110***	0.106***	0.109***	0.162***
	(0.009)	(0.009)	(0.011)	(0.010)	(0.009)	(0.010)	(0.009)	(0.041)
$[75, 90)$	0.081***	0.069***	0.050***	0.066***	0.106***	0.093***	0.092***	0.149***
	(0.009)	(0.009)	(0.012)	(0.011)	(0.008)	(0.009)	(0.010)	(0.039)
$[90, 105)$	0.061***	0.055***	0.042***	0.057***	0.096***	0.091***	0.090***	0.153***
	(0.008)	(0.008)	(0.011)	(0.008)	(0.008)	(0.010)	(0.009)	(0.042)
$[105, 120)$	0.069***	0.057***	0.035***	0.055***	0.084***	0.076***	0.068***	0.126***
	(0.010)	(0.011)	(0.012)	(0.012)	(0.009)	(0.010)	(0.010)	(0.036)
$[120, 135)$	0.052***	0.044***	0.025**	0.036***	0.067***	0.066***	0.062***	0.110***
	(0.010)	(0.011)	(0.012)	(0.011)	(0.008)	(0.010)	(0.010)	(0.035)
$[135, 150)$	0.040***	0.033***	0.014	0.029**	0.049***	0.051***	0.047***	0.097***
	(0.009)	(0.011)	(0.012)	(0.012)	(0.009)	(0.009)	(0.009)	(0.033)
$[150, 165)$	0.040***	0.032***	0.019	0.032***	0.060***	0.057***	0.051***	0.103***
	(0.009)	(0.010)	(0.012)	(0.009)	(0.008)	(0.011)	(0.011)	(0.037)
$[165, 180)$	0.035***	0.027**	0.018	0.028**	0.040***	0.041***	0.044***	0.085***
	(0.012)	(0.012)	(0.016)	(0.012)	(0.012)	(0.010)	(0.013)	(0.033)
$[180, 195)$	0.026***	0.015	0.006	0.025**	0.035***	0.028***	0.028***	0.071**
	(0.009)	(0.010)	(0.013)	(0.010)	(0.008)	(0.009)	(0.011)	(0.031)
$[195, 210)$	0.026***	0.035***	0.023**	0.042***	0.047***	0.051***	0.054***	0.105***
	(0.007)	(0.008)	(0.011)	(0.008)	(0.006)	(0.009)	(0.010)	(0.035)
$[210, 225)$	0.032***	0.019**	0.013	0.032***	0.039***	0.031***	0.031***	0.077**
	(0.009)	(0.009)	(0.012)	(0.010)	(0.008)	(0.009)	(0.011)	(0.030)
$[225, 240)$	0.016*	0.014	0.005	0.014	0.020***	0.025***	0.022*	0.057**
	(0.008)	(0.009)	(0.013)	(0.008)	(0.007)	(0.010)	(0.013)	(0.029)
$[240, 255)$	0.014**	0.011	0.003	0.023*	0.026***	0.017**	0.005	0.060**
	(0.007)	(0.008)	(0.016)	(0.013)	(0.006)	(0.008)	(0.025)	(0.030)
$[255, 270)$	0.023*	0.031*	-0.012	0.011	0.020**	0.036**	-0.004	0.044*
	(0.013)	(0.018)	(0.014)	(0.009)	(0.009)	(0.017)	(0.015)	(0.027)
$[270, 285)$	0.008	0.000	-0.017	-0.007	0.012*	0.009	-0.002	0.033
	(0.008)	(0.008)	(0.014)	(0.008)	(0.007)	(0.008)	(0.017)	(0.027)
$[285, 300)$	0.003	0.005	-0.007	0.014	0.003	0.005	-0.008	0.034
	(0.008)	(0.012)	(0.016)	(0.013)	(0.008)	(0.009)	(0.014)	(0.026)
Fixed Effects:								
Industry	Yes	Yes	Yes	Yes	No	No	No	No
Firm	No	No	No	No	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	692,265	668,559	652,125	640,654	670,775	646,898	630,308	618,704
R-squared	0.027	0.027	0.025	0.002	0.228	0.207	0.240	0.139

Notes: The dependent variable is the percentage change of the monthly wage growth of workers in each bin from 2007m12 to t relative to the group of workers who are in the wage bin $[300, \infty)$. The wage bins are defined in dollars relative to the minimum wage in the year 2008. Individual controls include age and gender. Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

5.4 Heterogeneous Wage Effects

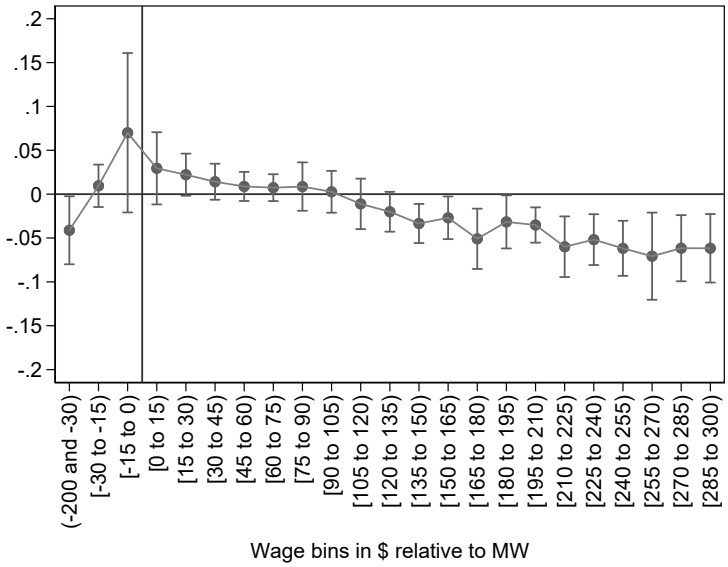
We investigate heterogeneous wage impacts across age groups by estimating the following regression:

$$\%\Delta W_{it} = \alpha + \sum_{b=(-200,-30)}^{[285,300)} \beta_b \mathbb{1}\{b = bin\} + \sum_{c=(-200,-30)}^{[285,300)} \beta_c \mathbb{1}\{c = bin\} \times \mathbb{1}\{age \in (0,25)\} + \gamma X_{i,2007M12} + \delta_{s(i),2007M12} + \varepsilon_{it} \quad (11)$$

where $\mathbb{1}\{age \in (0,25)\}$ is a dummy variable that equals one if the worker's age is under 25 and zero otherwise. The coefficients β_c measure differential wage impacts for young workers under age 25 relative to workers 25 and over within each bin.

Figure 7 displays the coefficient β_c along with 95 percent confidence intervals. After the wage bin $[135, 150)$, we found negative coefficients with statistical significance, meaning that positive spillover effects were reduced for young workers aged under 25 relative to older workers age 25 and over.

Figure 7: Wage premium for workers under age 25



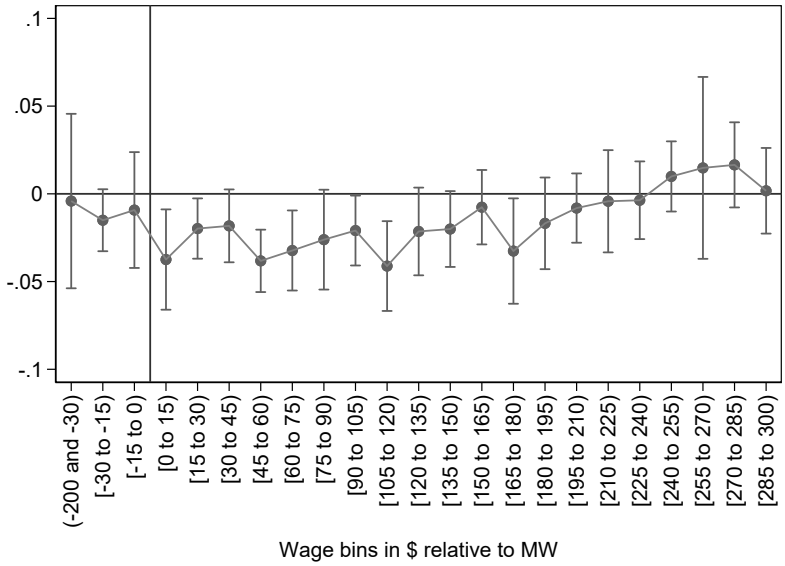
Notes: The figure displays the percentage change of the monthly wage growth of "Age Under 25" workers in each bin from 2007m12 to 2008m1 relative to "Age 25 and Over" group, after controlling for individual characteristics such as age, gender and industry fixed effects (see equation (11)). The coefficients β_c are displayed. Standard errors are clustered at the firm level. 95% confidence intervals are displayed. The wage bins are defined in dollars relative to the minimum wage in 2008. Hence, 0 on the vertical line represents $200.

Last, we study heterogeneous wage impacts for males and females by estimating the following regression:

$$\%\Delta W_{it} = \alpha + \sum_{b=(-200,-30)}^{[285,300)} \beta_b \mathbb{1}\{b = bin\} + \sum_{c=(-200,-30)}^{[285,300)} \beta_c \mathbb{1}\{c = bin\} \times F_i + \gamma X_{i,2007M12} + \delta_{s(i),2007M12} + \varepsilon_{it} \quad (12)$$

where F_i is a dummy variable that equals one if worker's gender is female and zero otherwise. The coefficients β_c measure differential wage impacts for female workers relative to male workers within each bin. Figure 8 displays the coefficient β_c along with 95 percent confidence intervals. From the wage bin $[0, 15)$ to the wage bin $[225, 240)$, we found negative coefficients. For some of those cases, we identify the statistical significance. This implies that positive spillover effects were lower for female workers than for male workers. Combining this finding with the previous employment effect by gender, we find that male workers are more likely to be laid off than female workers and that female workers are less likely to gain positive wage spillovers than male workers.

Figure 8: Wage premium for female workers



Notes: The figure displays the percentage change of the monthly wage growth of "Female" workers in each bin from 2007m12 to 2008m1 relative to "Male" workers, after controlling for individual characteristics such as age, gender and industry fixed effects (see equation (12)). The coefficients β_c are displayed. Standard errors are clustered at the firm level. 95% confidence intervals are displayed. The wage bins are defined in dollars relative to the minimum wage in the year 2008. Hence, 0 on the vertical line represents $200.

6 Conclusion

The 2008 Unified Minimum Wage hike in Ecuador provides a rare opportunity to study how firms adjust labor demand in response to minimum wage shocks. In Ecuador, the minimum wage setting has two parts, the Unified Minimum Wage (UMW) and Sectoral Minimum Wage (SMW), which typically made it difficult to investigate labor market impacts of minimum wages given its multiple layers and non-codified sector/occupation information. In the case of the 2008 minimum wage hike in Ecuador, because the SMW setting was not well organized in those times, there was a time gap between the effective date of the UMW and the effective date of the SMW. Therefore, before the enforcement of SMW, Ecuadorian firms took only the UMW into consideration in their labor demand decisions. We exploit this unique feature of Ecuadorian history to investigate how Ecuadorian firms adjust to the minimum wage shock. Data from the IESS, which covers all formal sector workers and firms at a monthly frequency, give us a unique longitudinal perspective over a period of time one to four months after the announcement date of the UMW in 2008.

Using this finely detailed administrative dataset, we implement a firm-level and worker-level difference-in-differences analysis to investigate the labor market impacts of the minimum wage increase in Ecuador. We find that the minimum wage hike led to a decrease in labor demand in affected firms and a decline in the probability of remaining employed for affected workers. In both cases, the treatment effects increase as time passes. We further uncover that a firm's margin of adjustment in response to the minimum wage resulted from both more layoffs and a slowdown of new hiring in the treated firms. We find sizable wage increases for those who had been earning less than the new minimum wage. Further, we identify the wage spillover effects up to the 77th percentile of the wage distribution. All in all, the 2008 minimum wage hike in Ecuador created a cost shock for Ecuadorian firms, and those treated firms adjusted by laying off workers and slowing the hiring of new workers.

We focus on overall employment, worker flows, and wage effects of the minimum wage. Future research could use this analysis to conduct further research. First, one could extend our analysis to study the reallocation effects of the minimum wage. For example, in their investigation of the reallocation effects of the minimum wage in Germany, Dustmann et al. (2020) find that the minimum wage induced low-wage workers to move from smaller firms to larger firms. Second, it would be interesting to analyze the impact of the minimum wage on firm exit, as Luca and Luca (2019) did; using Yelp reviews of Bay area restaurants, they found that restaurants with lower ratings are disproportionately driven

out of business by increases in the minimum wage.

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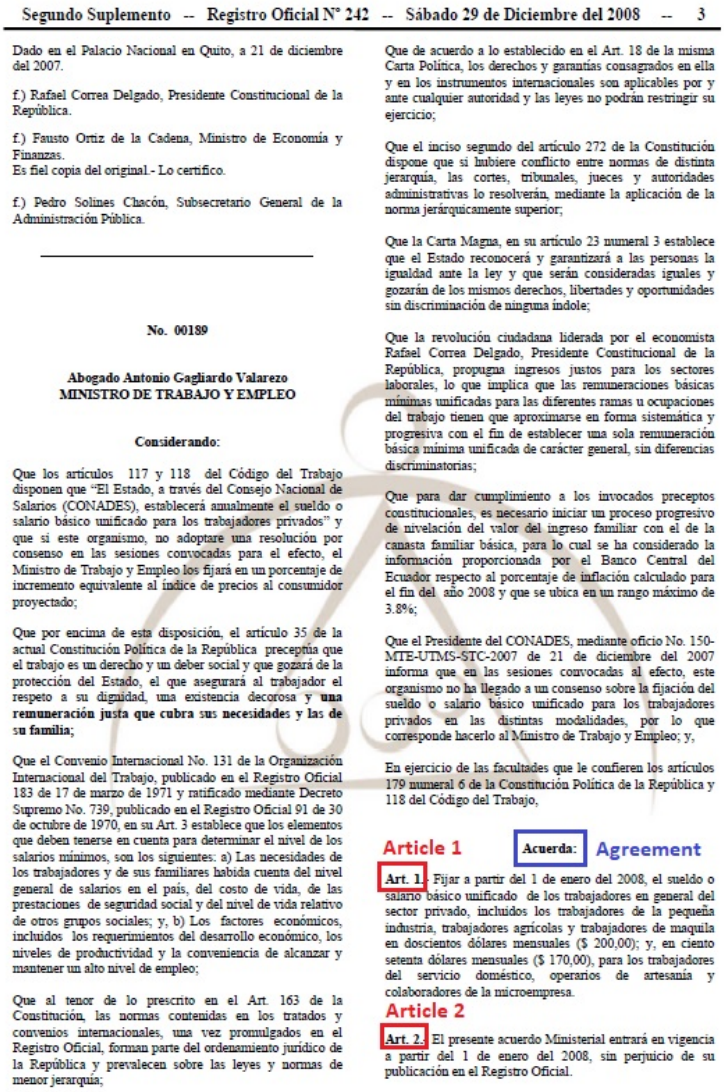
Appendix

Appendix A: Figures

Figure A.1: Registro Oficial No. 242 - page 3
(Example of the Unified Minimum Wage)



Segundo Suplemento -- Registro Oficial Nº 242 -- Sábado 29 de Diciembre del 2008 -- 3

Dado en el Palacio Nacional en Quito, a 21 de diciembre del 2007.

f.) Rafael Correa Delgado, Presidente Constitucional de la República.

f.) Fausto Ortiz de la Cadena, Ministro de Economía y Finanzas.
Es fiel copia del original - Lo certifico.

f.) Pedro Solines Chacón, Subsecretario General de la Administración Pública.

No. 00189

Abogado Antonio Gagliardo Valarezo
MINISTRO DE TRABAJO Y EMPLEO

Considerando:

Que los artículos 117 y 118 del Código del Trabajo disponen que "El Estado, a través del Consejo Nacional de Salarios (CONADES), establecerá anualmente el sueldo o salario básico unificado para los trabajadores privados" y que si este organismo, no adoptare una resolución por consenso en las sesiones convocadas para el efecto, el Ministro de Trabajo y Empleo los fijará en un porcentaje de incremento equivalente al índice de precios al consumidor proyectado;

Que por encima de esta disposición, el artículo 35 de la actual Constitución Política de la República preceptúa que el trabajo es un derecho y un deber social y que gozará de la protección del Estado, el que asegurará al trabajador el respeto a su dignidad, una existencia decorosa y **una remuneración justa que cubra sus necesidades y las de su familia;**

Que el Convenio Internacional No. 131 de la Organización Internacional del Trabajo, publicado en el Registro Oficial 183 de 17 de marzo de 1971 y ratificado mediante Decreto Supremo No. 739, publicado en el Registro Oficial 91 de 30 de octubre de 1970, en su Art. 3 establece que los elementos que deben tenerse en cuenta para determinar el nivel de los salarios mínimos, son los siguientes: a) Las necesidades de los trabajadores y de sus familiares habida cuenta del nivel general de salarios en el país, del costo de vida, de las prestaciones de seguridad social y del nivel de vida relativo de otros grupos sociales; y, b) Los factores económicos, incluidos los requerimientos del desarrollo económico, los niveles de productividad y la conveniencia de alcanzar y mantener un alto nivel de empleo;

Que al tenor de lo prescrito en el Art. 163 de la Constitución, las normas contenidas en los tratados y convenios internacionales, una vez promulgados en el Registro Oficial, forman parte del ordenamiento jurídico de la República y prevalecen sobre las leyes y normas de menor jerarquía;

Que de acuerdo a lo establecido en el Art. 18 de la misma Carta Política, los derechos y garantías consagrados en ella y en los instrumentos internacionales son aplicables por y ante cualquier autoridad y las leyes no podrán restringir su ejercicio;

Que el inciso segundo del artículo 272 de la Constitución dispone que si hubiere conflicto entre normas de distinta jerarquía, las cortes, tribunales, jueces y autoridades administrativas lo resolverán, mediante la aplicación de la norma jerárquicamente superior;

Que la Carta Magna, en su artículo 23 numeral 3 establece que el Estado reconocerá y garantizará a las personas la igualdad ante la ley y que serán consideradas iguales y gozarán de los mismos derechos, libertades y oportunidades sin discriminación de ninguna índole;

Que la revolución ciudadana liderada por el economista Rafael Correa Delgado, Presidente Constitucional de la República, propugna ingresos justos para los sectores laborales, lo que implica que las remuneraciones básicas mínimas unificadas para las diferentes ramas u ocupaciones del trabajo tienen que aproximarse en forma sistemática y progresiva con el fin de establecer una sola remuneración básica mínima unificada de carácter general, sin diferencias discriminatorias;

Que para dar cumplimiento a los invocados preceptos constitucionales, es necesario iniciar un proceso progresivo de nivelación del valor del ingreso familiar con el de la canasta familiar básica, para lo cual se ha considerado la información proporcionada por el Banco Central del Ecuador respecto al porcentaje de inflación calculado para el fin del año 2008 y que se ubica en un rango máximo de 3.8%;

Que el Presidente del CONADES, mediante oficio No. 150-MTE-UTMS-STC-2007 de 21 de diciembre del 2007 informa que en las sesiones convocadas al efecto, este organismo no ha llegado a un consenso sobre la fijación del sueldo o salario básico unificado para los trabajadores privados en las distintas modalidades, por lo que corresponde hacerlo al Ministro de Trabajo y Empleo; y,

En ejercicio de las facultades que le confieren los artículos 179 numeral 6 de la Constitución Política de la República y 118 del Código del Trabajo,

Article 1 **Acuerda:** **Agreement**

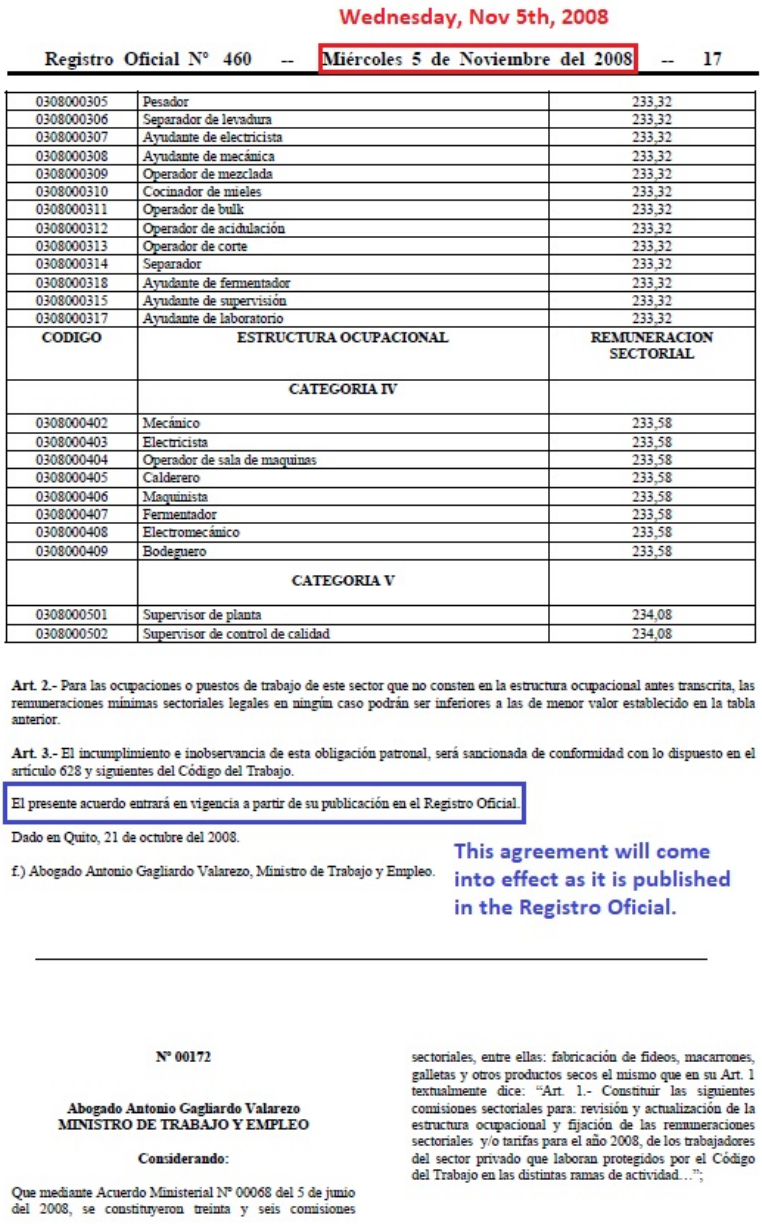
Art. 1.- Fijar a partir del 1 de enero del 2008, el sueldo o salario básico unificado de los trabajadores en general del sector privado, incluidos los trabajadores de la pequeña industria, trabajadores agrícolas y trabajadores de maquila en doscientos dólares mensuales ($ 200,00); y, en ciento setenta dólares mensuales ($ 170,00), para los trabajadores del servicio doméstico, operarios de artesanía y colaboradores de la microempresa.

Article 2

Art. 2.- El presente acuerdo Ministerial entrará en vigencia a partir del 1 de enero del 2008, sin perjuicio de su publicación en el Registro Oficial.

Notes: The figure is taken from Registro Oficial No. 242. English translations for Articles 1 and 2 are as follows:
Article 1. As of January 1, 2008, the unified basic salary of workers in general in the private sector, including workers in small industries, agricultural workers, and maquila workers is two hundred dollars a month ($200); and one hundred and seventy dollars a month ($170) for domestic service workers, craft workers and collaborators of the microenterprise.
Article 2. This Ministerial Agreement will come into effect on January 1, 2008, without prejudice to its publication in the Registro Oficial.

Figure A.2: Registro Oficial No. 460 - page 17
(Example of the Sectoral Minimum Wage)



Wednesday, Nov 5th, 2008

Registro Oficial Nº 460 -- Miércoles 5 de Noviembre del 2008 -- 17

0308000305	Pesador	233,32
0308000306	Separador de levadura	233,32
0308000307	Ayudante de electricista	233,32
0308000308	Ayudante de mecánica	233,32
0308000309	Operador de mezclada	233,32
0308000310	Cocinador de mieles	233,32
0308000311	Operador de bulk	233,32
0308000312	Operador de acidulación	233,32
0308000313	Operador de corte	233,32
0308000314	Separador	233,32
0308000318	Ayudante de fermentador	233,32
0308000315	Ayudante de supervisión	233,32
0308000317	Ayudante de laboratorio	233,32
CODIGO	**ESTRUCTURA OCUPACIONAL**	**REMUNERACION SECTORIAL**
	CATEGORIA IV	
0308000402	Mecánico	233,58
0308000403	Electricista	233,58
0308000404	Operador de sala de maquinas	233,58
0308000405	Calderero	233,58
0308000406	Maquinista	233,58
0308000407	Fermentador	233,58
0308000408	Electromecánico	233,58
0308000409	Bodeguero	233,58
	CATEGORIA V	
0308000501	Supervisor de planta	234,08
0308000502	Supervisor de control de calidad	234,08

Art. 2.- Para las ocupaciones o puestos de trabajo de este sector que no consten en la estructura ocupacional antes transcrita, las remuneraciones mínimas sectoriales legales en ningún caso podrán ser inferiores a las de menor valor establecido en la tabla anterior.

Art. 3.- El incumplimiento e inobservancia de esta obligación patronal, será sancionada de conformidad con lo dispuesto en el artículo 628 y siguientes del Código del Trabajo.

El presente acuerdo entrará en vigencia a partir de su publicación en el Registro Oficial.

Dado en Quito, 21 de octubre del 2008.

f.) Abogado Antonio Gagliardo Valarezo, Ministro de Trabajo y Empleo.

This agreement will come into effect as it is published in the Registro Oficial.

Nº 00172

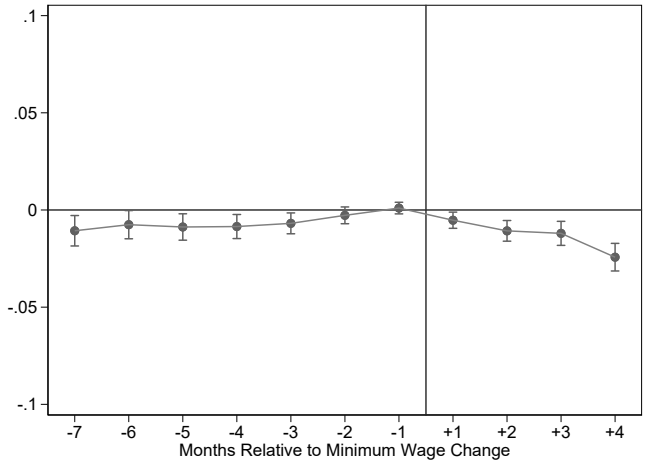
Abogado Antonio Gagliardo Valarezo
MINISTRO DE TRABAJO Y EMPLEO

Considerando:

Que mediante Acuerdo Ministerial Nº 00068 del 5 de junio del 2008, se constituyeron treinta y seis comisiones sectoriales, entre ellas: fabricación de fideos, macarrones, galletas y otros productos secos el mismo que en su Art. 1 textualmente dice: "Art. 1.- Constituir las siguientes comisiones sectoriales para: revisión y actualización de la estructura ocupacional y fijación de las remuneraciones sectoriales y/o tarifas para el año 2008, de los trabajadores del sector privado que laboran protegidos por el Código del Trabajo en las distintas ramas de actividad…";

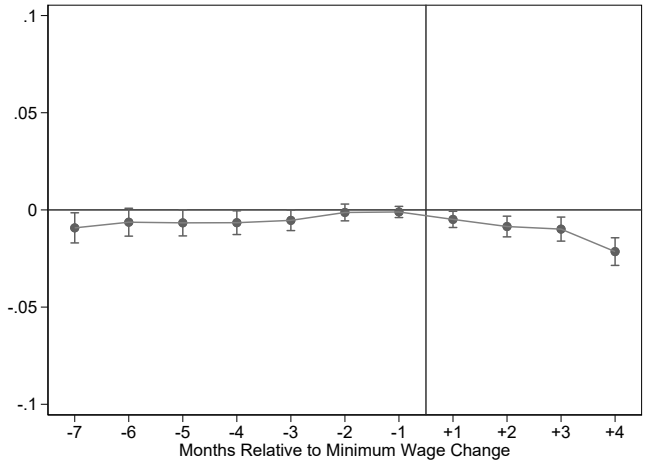
Notes: The figure is taken from Registro Oficial No. 460. The table denotes the remuneration amount for Elaboration of Other Food Products (Sector No. 35 in Appendix Table B.2). The publication date of Registro Oficial No. 460 is Wednesday, November 5, 2008 (in red). As documented in blue, the agreement comes into effect once it is published in the Registro Oficial.

Figure A.3: Dynamics of Treatment Effects, 2007M5 - 2008M4
(Based on November 2007)



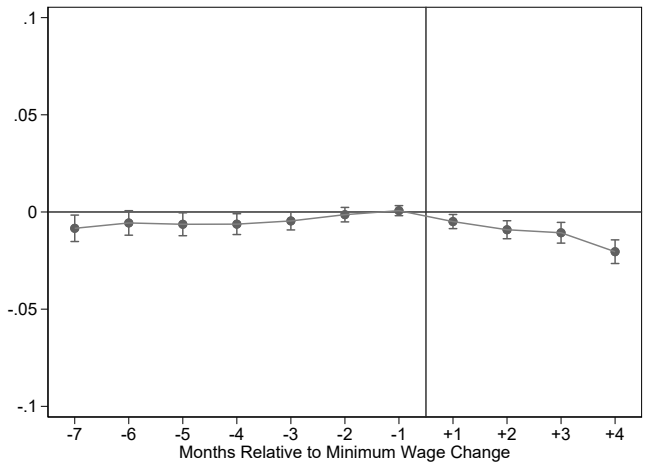
Notes: The figure displays the treatment effects on employment relative to the month of the minimum wage event by estimating equation (2). The dependent variable is the log of the total number of formal workers. Regressions include firm and industry-time fixed effects. Standard errors are clustered at the firm level. 95% confidence intervals are displayed. The sample period is from 2007m5 to 2008m4.

Figure A.4: Dynamics of Treatment Effects, 2007M5 - 2008M4
(Based on October 2007)



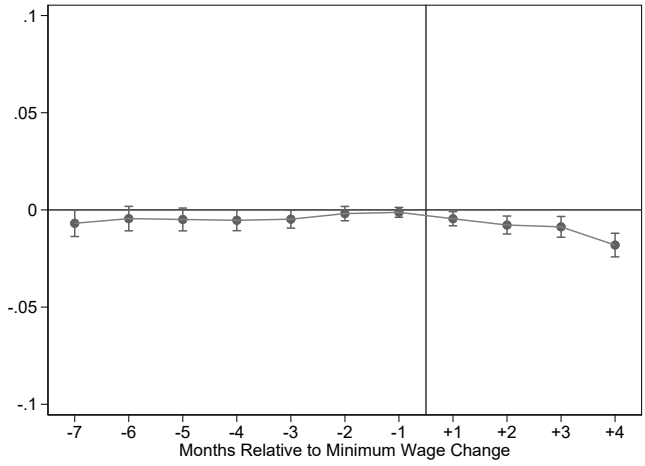
Notes: The figure displays the treatment effects on employment relative to the month of the minimum wage event by estimating equation (2). The dependent variable is the log of the total number of formal workers. Regressions include firm and industry-time fixed effects. Standard errors are clustered at the firm level. 95% confidence intervals are displayed. The sample period is from 2007m5 to 2008m4.

Figure A.5: Dynamics of Treatment Effects for Dummy Treatment, 2007M5 - 2008M4 (Based on November 2007)



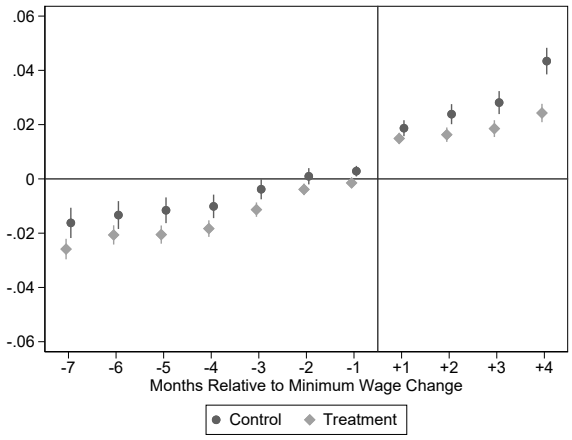
Notes: The figure displays the treatment effects on employment relative to the month of the minimum wage event. The dependent variable is the log of the total number of formal workers. Regressions include firm and industry-time fixed effects. Standard errors are clustered at the firm level. 95% confidence intervals are displayed. The sample period is from 2007m5 to 2008m4.

Figure A.6: Dynamics of Treatment Effects for Dummy Treatment, 2007M5 - 2008M4 (Based on October 2007)



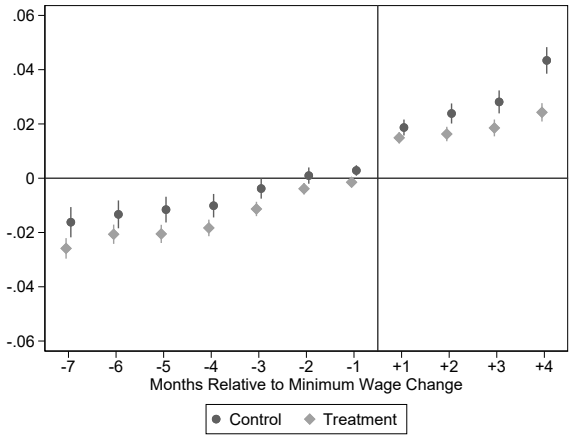
Notes: The figure displays the treatment effects on employment relative to the month of the minimum wage event. The dependent variable is the log of the total number of formal workers. Regressions include firm and industry-time fixed effects. Standard errors are clustered at the firm level. 95% confidence intervals are displayed. The sample period is from 2007m5 to 2008m4.

Figure A.7: Event Study Result, 2007M5 - 2008M4
(Based on November 2007)



Notes: The figure displays the coefficients of employment relative to the month of the minimum wage event by estimating equation (4) separately for the treatment group, $\mathbb{1}\{> 50\%$ rule$\}$, and for the control group, $\mathbb{1}\{\leq 50\%$ rule$\}$. The dependent variable is the log of the total number of formal workers. Regressions include firm fixed effects. Standard errors are clustered at the firm level. 95% confidence intervals are displayed. The sample period is from 2007m5 to 2008m4.

Figure A.8: Event Study Result, 2007M5 - 2008M4
(Based on October 2007)



Notes: The figure displays the coefficients of employment relative to the month of the minimum wage event by estimating equation (4) separately for the treatment group, $\mathbb{1}\{> 50\%$ rule$\}$, and for the control group, $\mathbb{1}\{\leq 50\%$ rule$\}$. The dependent variable is the log of the total number of formal workers. Regressions include firm fixed effects. Standard errors are clustered at the firm level. 95% confidence intervals are displayed. The sample period is from 2007m5 to 2008m4.

Appendix B: Tables

Table B.1: Industry Classification

No.	Broad Industry Description	No.	Narrow Industry Description
Panel A. Selected Industries			
1	Agriculture, Hunting, Forestry and Fisheries	A01	Agriculture and Plantations
1	Agriculture, Hunting, Forestry and Fisheries	A02	Livestock Production
1	Agriculture, Hunting, Forestry and Fisheries	A03	Fisheries
2	Mines and Quarries	A04	Mines and Quarries
3	Manufacturing	A05	Food Processing
3	Manufacturing	A06	Industrial, Pharmaceutical, and Chemical Products
3	Manufacturing	A07	Beverages and Tobacco
3	Manufacturing	A08	Metal Mechanics
3	Manufacturing	A10	Textile, Leather, and Footwear
3	Manufacturing	A11	Vehicles, Automotives, Bodywork, and Parts
3	Manufacturing	A12	Hardware and Software Technology (Incl. ICT)
4	Electricity, Gas, and Water	A13	Electricity, Gas, and Water
5	Construction	A14	Construction
6	Wholesale and Retail, Restaurants and Hotels	A15	Commerce and Sale of Products
6	Wholesale and Retail, Restaurants and Hotels	A16	Tourism and Food
7	Transportation, Storage, and Communications	A17	Transport and Logistics
8	Financial Institutions, Insurance, and Real Estate	A18	Financial Services
9	Community, Social, and Personal Services	A22	Community Services
		A20	Teaching
		A21	Health Services
Panel B. Non-Selected Industries			
		A19	Services
10	Public Services		
11	Handcraft Activities	A09	Handcraft
98	Outsourcing Activities		
99	Activities that do not have classification codes		

Notes: The table describes industry codes in the dataset. Each observation can have only one industry code (i.e., either Broad Industry or Narrow Industry) in our dataset. There is one-to-many mapping between Broad Industry and Narrow Industry. Three narrow industries (A19, A20, and A21) and three broad industries (10, 98, and 99) do not have a clear mapping between the two. In our analysis, we selected 11 industries (from 1. Agriculture, Hunting, Forestry and Fisheries to 9. Community, Social, and Personal Services, A20. Teaching, and A21. Health Services); while we dropped other industries (A19 Services, 10. Public Services, 11. Handcraft Activities, A09. Handcraft, 98. Outsourcing Activities, 99. Activities that do not have classification codes).

Table B.2: Timeline of Minimum Wages in Ecuador, 2008

No.	Sector Description	Ministerial Agreement No.	Ministerial Agreement Date	Registro Oficial No.	Registro Oficial Date
0	Unified Minimum Wage (UMW)	00189	Dec/27/2007	242	Dec/29/2007
1	Fluvial, Coastal and International Traffic	00068	Jun/05/2008	423	Sep/11/2008
2	Malted Beverage and Beer	00068	Jun/05/2008	424	Sep/12/2008
3	Rice Mill	00068	Jun/05/2008	432	Sep/24/2008
4	Production of Dairy Products	00068	Jun/05/2008	432	Sep/24/2008
5	Financial Companies	00068	Jun/05/2008	432	Sep/24/2008
6	Production of Salt	00068	Jun/05/2008	432	Sep/24/2008
7	Manufacture of Energy Accumulators	00068	Jun/05/2008	432	Sep/24/2008
8	Automobile Manufacturing: Parts and Pieces	00068	Jun/05/2008	432	Sep/24/2008
9	Industry of Wood Except Furniture	00068	Jun/05/2008	432	Sep/24/2008
10	Telecommunications Technicians	00068	Jun/05/2008	432	Sep/24/2008
11	Poultry Production and Chores	00068	Jun/05/2008	432	Sep/24/2008
12	Manufacture of Mattresses	00068	Jun/05/2008	432	Sep/24/2008
13	Manufacture of Hand Tools and Hardware	00068	Jun/05/2008	432	Sep/24/2008
14	Manufacture of Pharmaceutical Products	00068	Jun/05/2008	432	Sep/24/2008
15	Wood Extraction	00068	Jun/05/2008	432	Sep/24/2008
16	Tobacco Industry	00068	Jun/05/2008	432	Sep/24/2008
17	Manufacture of Structural Metal Products	00068	Jun/05/2008	432	Sep/24/2008
18	Manufacture of Other Non-Metallic Mineral	00068	Jun/05/2008	432	Sep/24/2008
19	Livestock Slaughter and Preservation of Meat	00068	Jun/05/2008	432	Sep/24/2008
20	Vegetable and Animal Oils and Fat	00068	Jun/05/2008	432	Sep/24/2008
21	Manufacture of Paper and Paper Products	00068	Jun/05/2008	432	Sep/24/2008
22	Production of Food for Animals	00068	Jun/05/2008	432	Sep/24/2008
23	Production of Bakery and Pastry Products	00068	Jun/05/2008	432	Sep/24/2008
24	Manufacture of Plastic Products	00068	Jun/05/2008	432	Sep/24/2008
25	Guard and Private Security Companies	00068	Jun/05/2008	432	Sep/24/2008
26	Concierge, Doorman and Cleaning	00079	Jun/07/2008	432	Sep/24/2008
27	Real Estate and Real Estate Brokers	00079	Jun/07/2008	432	Sep/24/2008
28	Packaging and Canned Industries of Fruits	00068	Jun/05/2008	458	Oct/31/2008
29	Manufacture of Paints, Vanishes, and Lacquers	00068	Jun/05/2008	458	Oct/31/2008
30	Ecuadorian Port System	00079	Jun/07/2008	458	Oct/31/2008
31	Wholesale and Retail	00079	Jun/07/2008	459	Nov/04/2008
32	Laundry and Dying Companies	00079	Jun/07/2008	459	Nov/04/2008
33	Food and Beverage Services	00079	Jun/07/2008	459	Nov/04/2008
34	Manufacture of Noodles, Macaroni, and Cookies	00068	Jun/05/2008	460	Nov/05/2008
35	Elaboration of Other Food Products	00068	Jun/05/2008	460	Nov/05/2008
36	Brick and Clay Roof Tile Manufacturing	00068	Jun/05/2008	461	Nov/06/2008
37	Accessories and Electrical Supplies	00068	Jun/05/2008	461	Nov/06/2008
38	Theaters and Cinema	00079	Jun/07/2008	461	Nov/06/2008
39	Fish and other Marine Products	00068	Jun/05/2008	473	Nov/24/2008
40	Prints, Publishers, and Related Industries	00068	Jun/05/2008	474	Nov/25/2008
41	Food Provision on Demand	00079	Jun/07/2008	474	Nov/25/2008
42	Sugar Factories and Refineries	00068	Jun/05/2008	475	Nov/26/2008

Notes: The table describes timeline of Ministerial Agreement and Registro Oficial associated with minimum wages in Ecuador. The Unified Minimum Wage (UMW) became effective from the date of the ministerial agreement. The Sectoral Minimum Wages (SMW) became effective from the date of the publication of Registro Oficial. We assign No. 0 to the UMW. Other sectors are sorted according to the date of effective date of the minimum wage (i.e., the date of publication of Registro Oficial). There are five additional sectors (47 in total) that are not included in the table; because it is not easy to define monthly wages in those sectors, the Ministry of Labor of Ecuador determined the payment by task in those five sectors.

Table B.3: Industry Heterogeneity I

	Dependent Variable: Log of Employment			
Sample	+/- 1m	+/- 2m	+/- 3m	+/- 4m
	(1)	(2)	(3)	(4)
Industry 1. Agriculture, Hunting, Forestry and Fisheries				
FA × Post	-0.024**	-0.030**	-0.030**	-0.038**
	(0.012)	(0.013)	(0.015)	(0.016)
Observations	8,480	16,967	25,317	33,536
R-squared	0.993	0.987	0.983	0.977
Industry 2. Mines and Quarries				
FA × Post	0.003	-0.003	0.006	0.004
	(0.039)	(0.041)	(0.045)	(0.049)
Observations	708	1,416	2,115	2,801
R-squared	0.989	0.986	0.978	0.969
Industry 3. Manufacturing				
FA × Post	-0.013**	-0.017***	-0.021***	-0.032***
	(0.006)	(0.006)	(0.007)	(0.008)
Observations	15,302	30,576	45,684	60,638
R-squared	0.994	0.990	0.986	0.981
Industry 4. Electricity, Gas and Water				
FA × Post	-0.035	-0.053	-0.068	-0.096**
	(0.032)	(0.038)	(0.042)	(0.045)
Observations	876	1,757	2,611	3,446
R-squared	0.991	0.982	0.977	0.971
Fixed Effects:				
Firm	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes

Notes: The dependent variable is the log of the total number of formal workers. In Column (1), the sample period is from 2007m12 to 2008m1. In Column (2), the sample period is from 2007m11 to 2008m2. In Column (3), the sample period is from 2007m10 to 2008m3. In Column (4), the sample period is from 2007m9 to 2008m4. D_i is a dummy variable that equals one if a firm's share of workers who receive less than \$200 (the monthly minimum wage in 2008) in 2007m12 is equal or greater than $x\%$ and 0 otherwise. Post is a dummy variable that equals 1 if after 2008m1 and 0 otherwise. Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

Table B.4: Industry Heterogeneity II

	Dependent Variable: Log of Employment			
Sample	+/- 1m	+/- 2m	+/- 3m	+/- 4m
	(1)	(2)	(3)	(4)
Industry 5. Construction				
FA × Post	-0.008	-0.005	-0.006	-0.009
	(0.009)	(0.011)	(0.012)	(0.012)
Observations	10,282	20,576	30,419	40,014
R-squared	0.982	0.965	0.952	0.940
Industry 6. Wholesale and Retail, Restaurants and Hotels				
FA × Post	-0.000	-0.001	-0.001	-0.002
	(0.003)	(0.004)	(0.004)	(0.004)
Observations	46,867	93,792	139,783	185,087
R-squared	0.992	0.986	0.981	0.976
Industry 7. Transportation, Storage and Communications				
FA × Post	0.004	0.002	0.002	0.007
	(0.006)	(0.006)	(0.007)	(0.007)
Observations	9,956	19,928	29,685	39,317
R-squared	0.992	0.987	0.982	0.977
Industry 8. Financial Institutions, Insurance, and Real Estate				
FA × Post	0.006	0.000	-0.002	-0.004
	(0.009)	(0.010)	(0.011)	(0.011)
Observations	5,782	11,575	17,226	22,801
R-squared	0.994	0.988	0.984	0.980
Fixed Effects:				
Firm	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes

Notes: The dependent variable is the log of the total number of formal workers. In Column (1), the sample period is from 2007m12 to 2008m1. In Column (2), the sample period is from 2007m11 to 2008m2. In Column (3), the sample period is from 2007m10 to 2008m3. In Column (4), the sample period is from 2007m9 to 2008m4. D_i is a dummy variable that equals one if a firm's share of workers who receive less than \$200 (the monthly minimum wage in 2008) in 2007m12 is equal or greater than $x\%$ and 0 otherwise. Post is a dummy variable that equals 1 if after 2008m1 and 0 otherwise. Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

Table B.5: Industry Heterogeneity III

	Dependent Variable: Log of Employment			
Sample	+/- 1m	+/- 2m	+/- 3m	+/- 4m
	(1)	(2)	(3)	(4)
Industry 9. Community, Social and Personal Services				
FA × Post	-0.009*	-0.006	-0.003	-0.002
	(0.005)	(0.005)	(0.006)	(0.006)
Observations	20,782	41,579	61,740	81,478
R-squared	0.992	0.985	0.979	0.973
Industry A20. Teaching				
FA × Post	-0.005	0.001	0.000	0.001
	(0.009)	(0.012)	(0.013)	(0.014)
Observations	4,820	9,626	14,385	19,106
R-squared	0.995	0.989	0.984	0.980
Industry A21. Health Services				
FA × Post	0.005	0.003	-0.000	-0.004
	(0.007)	(0.007)	(0.008)	(0.009)
Observations	6,584	13,158	19,652	26,071
R-squared	0.995	0.991	0.987	0.984
Fixed Effects:				
Firm	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes

Notes: The dependent variable is the log of the total number of formal workers. In Column (1), the sample period is from 2007m12 to 2008m1. In Column (2), the sample period is from 2007m11 to 2008m2. In Column (3), the sample period is from 2007m10 to 2008m3. In Column (4), the sample period is from 2007m9 to 2008m4. D_i is a dummy variable that equals one if a firm's share of workers who receive less than \$200 (the monthly minimum wage in 2008) in 2007m12 is equal or greater than $x\%$ and 0 otherwise. Post is a dummy variable that equals 1 if after 2008m1 and 0 otherwise. Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.